A NOTE-BOOK
OF
AGRICULTURAL FACTS AND FIGURES

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A NOTE-BOOK

OF

AGRICULTURAL FACTS AND FIGURES

COMPILED BY

R. CECIL WOOD, M.A.

Madras Agricultural Department

(1982)

FOURTH EDITION

MADRAS

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS

1928

PRICE, 1 *rupee*] FASLI 1337

First Edition	...	...	1,000 copies, 1915.
Second Edition	...	...	1,500 copies, 1916.
Third Edition	...	...	2,500 copies, 1920.
Fourth Edition	...	...	2,500 copies, 1928.

PREFACE TO FOURTH EDITION.

THE third edition of this book was published in 1920 and such has been its popularity that the 2,500 copies struck off have been sold and in the middle of 1927 it was out of print. An edition in the vernacular, Tamil, is now available.

In issuing a fourth edition the opportunity has been taken to correct a few mistakes and to add a few more tables and some information in the subject of fodders and plant pests and diseases, but the bulk of the work remained in the form in which it was originally compiled by Mr. Wood.

MADRAS,
April 1928.

RUDOLPH D. ANSTEAD,
Director of Agriculture.

PREFACE TO THIRD EDITION.

THE few years since this book was first published in 1915, have seen a considerable increase in the interest taken by the man in the street in Agriculture and the production of grain, and the increased demand for the present publication has necessitated a third edition. Opportunity has been taken to revise and correct it where possible, but the work has had to be done intermittently and in my scanty leisure, and I trust its users will pardon the many mistakes. I have not altered the figures for costing : all values are shifting relatively and actually, and I have thought it better to stick to the pre-war figures, which at any rate represent a fairly well-defined standard.

I am responsible for the arrangement of the matter, but I need hardly say that without the generous assistance of my colleagues on the staff of this department the book could not have been compiled. I desire to express my thanks to Mr. Cecil Fischer, of the Indian Forest Service, for the notes on the timber trees of the Presidency. I wish also to express my thanks to the Government of Madras, for the generous way in which they have recognized my efforts.

MADRAS,
January 1920.

R. CECIL WOOD.

CONTENTS.

	PAGE
Weights and Measures	1
Mensuration and Surveying	20
Buildings and Roads	29
Machinery	30
Labour	37
Soils	48
Manures	51
Crops	63
Foods and Feeding	104
Live-stock	117
Dairying	164
Common Insect Pests	169
Common Fungus Diseases	174
Horticulture	183
Timber Trees	195
Statistics	202
Calendar	223
Index	225

NOTE-BOOK

OF

AGRICULTURAL FACTS AND FIGURES.

WEIGHTS AND MEASURES.

Imperial Avoirdupois Weight.

27·34 grains (gr.)	= 1 drachm (dr.).
16 drachms	= 1 ounce (oz.).
16 ounces [7,000 grains] ...	= 1 pound (lb.).
14 pounds	= 1 stone (st.).
28 pounds	= 1 quarter (qr.).
4 quarters	= 1 hundredweight (cwt.).
112 pounds	= 1 hundredweight.
20 hundredweights	= 1 ton.

Imperial Indian Weight.

(*Used in Railways.*)

10 tolas	= 1 chittak.
8 chittaks	= 1 seer.
40 seers...	= 1 maund.

A tola is the weight of a rupee and is ·4114 oz. or 180 grains. One seer weighs 2·057 lb. avoirdupois, and one maund 82·28 lb.

Madras Weight.

3 tolas	= 1 palam.
8 palams	= 1 seer.
5 seers	= 1 viss.
8 visses	= 1 maund.
20 maunds	= 1 candy.

A viss is 3·0857 lb. A Madras maund is thus nearly 25 lb. avoirdupois (24·68), and a candy is generally taken at 500 lb. 1 lb. = 38·88 tolas.

The table used by European merchants in Madras is slightly different from the above and is as follows :—

1 palam	= $1\frac{1}{4}$ oz. avoirdupois.
40 palams	= 1 viss = $3\frac{1}{8}$ lb.
8 visses	= 1 maund = 25 lb.
20 maunds	= 1 candy or baram = 500 lb.

Imperial Measures of Capacity.

5 fluid ounces of water ...	= 1 gill.
4 gills	= 1 pint (pt.).
2 pints	= 1 quart (qt.).
4 quarts	= 1 gallon (gal.).
2 gallons	= 1 peck (pk.).
4 pecks	= 1 bushel (bus.).
8 bushels	= 1 quarter (qr.).

A gallon contains 277·463 c. inches and equals 10 lb. of distilled water at 62° F.

6·25 gallons	= 1 cubic foot.
1 gallon	= ·16 cubic foot.

1 fluid ounce pure water weighs 1 oz. avoirdupois.

"A pint of pure water weighs a pound and a quarter."

Madras Measures of Capacity.

These are extremely variable, and only a few of the most widely known are given.

8 ollocks	= 1 Madras measure (M.M.), pucka or padi.
8 Madras measures ...	= 1 marakkal.
1 marakkal = $\frac{1}{2}$ cub. foot.	= 500 fluid oz.

The type Madras measure is 108 inches cubic capacity, contains 62·5 fluid ounces and is usually 4·5 inches in diameter and 6·75 inches deep.

In Madras and Saidapet it is struck: elsewhere it is heaped.

The seer when used as a measure is about 80 tolas: but varies with the commodity that is being used.

Imperial Linear Measure.

3 barleycorns	= 1 inch (in.).
12 inches	= 1 foot (ft.).

3 feet	...	...	...	= 1 yard (yd.).
5½ yards	...	...	...	= 1 pole (po.).
40 poles	...	...	...	= 1 furlong (fur.).
8 furlongs	...	...	...	= 1 mile (m.).
3 miles	...	...	...	= 1 league (lea.).

The chain used for measuring land is 4 poles or 22 yards and consists of 100 links, each link being $\frac{22}{100}$ yd. or 7·92 inches long.

10,000 sq. links	...	...	...	= 1 sq. chain.
100,000 sq. lks. or 10 sq. chains	...			= 1 acre.

A quarter anna is 1 inch in diameter.
A fathom ... ... = 2 yards.
A hand (for measuring animals) ... ... = 4 inches.

Imperial Square Measure.

144 sq. inches		...	...	= 1 sq. foot (sq. ft.).
9 sq. feet	...	...	...	= 1 sq. yard (sq. yd.).
30¼ sq. yards	...	...	...	= 1 sq. pole (sq, po.).
40 sq. poles	...	...	...	= 1 rood (ro.).
4 roods	...	...	...	= 1 acre (ac.).
640 acres	...	...	...	= 1 sq. mile (sq. m.).
6,272,640 sq. inches	...	...	...	= 1 acre.
43,560 sq. feet	...		...	= 1 ,,
4,840 sq. yards	...	..	...	= 1 ,,
160 sq. roods	...	...	...	= 1 ,,
10 sq. chains	...	...	...	= 1 ,,

The acre is universally used in revenue accounts, though different districts still use their local land measures. It is divided into cents each $\frac{1}{100}$ part of an acre.

An acre has roughly four equal sides of 70 yards (208·71 feet).

Imperial Cubic Measure.

1,728 cubic inches	...	...	= 1 cubic foot.
27 cubic feet	...	...	= 1 cubic yard.

FASLI.

1330	...	...	...	July 1, 1919 —June 30, 1920.
1331	...	...	...	July 1, 1920 — June 30, 1921.

LOCAL WEIGHTS AND MEASURES.

ANANTAPUR.

Table of Weights.

21	tolas (or ·4114 of an oz.)	=	1 seer.
$1\frac{1}{2}$	seers	=	1 sava seer.
2	sava seers	=	1 adi seer (3 seers).
2	adi seers	=	1 panch seer (6 seers).
12	seers	=	1 dhadiyam.
4	dhadiyams	=	1 maund (25·92 lb.).
	ara seer	=	$\frac{1}{2}$ seer.
	pavu	=	$\frac{1}{4}$ seer.
	ara pavu	=	$\frac{1}{8}$ seer.
	chattak	=	$\frac{1}{16}$ seer.

A seer of gold or silver weighs, as elsewhere, 24 tolas.

Grain Measure.

1 seer=88 tolas weight of second sort rice heaped divided into ara, pavu, etc., as before.

The next largest measure above the seer is the muntha whose capacity differs from taluk to taluk.

16	munthas	=	1 thumu.
20	thumus	=	1 putti

The thumu and the putti are as inconstant in value as the muntha itself.

Liquid Measure.

The grain seer is used for milk, buttermilk and curd. Oil and ghee are generally sold by weight.

BELLARY.

Weights.

Same as Anantapur.

Grain Measures.

1 seer = 84 tolas weight of a mixture of the 9 grains known as navadhanya.

which seems = 86 tolas weight of paddy divided into ara, pavu, etc.

The multiples of this seer differ in different taluks: in Bellary taluk a putti weighs 2,560 seers.

Liquid Measures.

Same as Anantapur.

CHINGLEPUT.

1 gundu of firewood	...	= 56 lb.
8 ollocks	...	= 1 M.M.
4 M.M.	...	= 1 Tiruvellur jodu.

CHITTOOR.

2 visses	...	= 1 dhadiyam.
4 dhadiyams or 8 viss. ...	...	= 1 maund.
20 maunds	...	= 1 baruva.
6 visses	...	= 1 muddhadiyam.
1½ visses is taken as	...	= 1 dhadiyam. in Chittoor and Chandragiri taluks.

Measures—Grain Measures.

Madanapalle Division.

2 Madras measure	...	= 1 muntha.
8 munthas ...	...	= 1 thoomu.
5 thoomulu ...	...	= 1 yedumu.
2 Yedumulu ...	...	= 1 pandumu.
2 pandumulu ...	...	= 1 putti (320 Madras measures).

CHITTOOR AND CHANDRAGIRI.

64 Madras measures	...	= 1 putti.
20 ballala	...	= 1 pandumu.
2 pandumus ...	...	= 1 putti.

Well Measurement.

4 × 4 × 4 muras ...	...	= 1 kunta.

COIMBATORE.

8 rupees wt. ...	...	= 1 palam.
15 palams	...	= 1 viss.
8 visses	...	= 1 maund.
10 maunds		= 1 pothy.
20 maunds	...	= 1 baram.
12 tulams	...	= 1 pothy.

A palam of 3 rupees is used for drugs.

2 M.M.	...	...	...	= 1 vallam.
33 vallams	...	...	...	= 1 selagai.

There are a number of local measures which are gradually being replaced by the standard M.M.

The Coimbatore vallam is larger than the standard one and 30 only go to the selagai.

1 maund of jaggery ... = 26 lb.

When firewood is sold by the ton, the maund is often taken at 28 lb., i.e., 80th of a ton.

CUDDAPAH.

32 M.M	...	...	...	= 1 thumu.
20 thumus	...	...	...	= 1 putti.

GANJAM.

WEIGHTS.

80 tolas	...	...	...	= 1 seer.
5 seers	...	...	...	= 1 viss.
8 visses	...	...	...	= 1 maund.
8 maunds	...	...	...	= 1 candy.

For gingelly, castor, coconut-oil and ghee, 1 seer = 22 tolas.

For onions, garlic, saffron, tamarind, potatos and silk, 1 seer = 24 tolas.

For chillies	...	...	1 seer = 105 tolas.
For vegetables, etc.	...		1 seer = 180 tolas.
For camphor, spices	...		1 viss = 118 tolas.

LAND MEASURE.

4 seers of rice and other grains				= 1 thumu.
16 seers ...	...	...	...	= 1 nowtie (cent).
20 nowties	...	...	...	= 1 bharanam.
100 nowties	...	...	...	= 1 acre.

GŌDĀVARI.

WEIGHTS.

2 pampus	...	...	...	= 1 yebulam.
2 yebulams	...	...	..	= 1 padalam.

2 padalams	... ...	= 1 viss (5 seers or 120 tolas).
2 visses	... ...	= 1 yettedu.
4 yettedus	... ...	= 1 maund (or 25 lb.).
20 maunds	... ...	= 1 putti (or candy).

Fuel is sold by the following table :—

5 maunds	... ...	= 1 kavadi.
4 kavadis	... ...	= 1 putti.
1 putti dry jungle wood	...	= 500 lb.
1 putti green jungle wood	...	= 612 lb.
1 putti of jaggery	... ...	= 504 lb.

Grain Measures.

5 tolas weight of rice	...	= 1 gidda.
4 giddas	... ...	= 1 sola.
2 solas	... ...	= 1 manika or seer (holds 80 tolas weight of rice).
2 manikas	... ...	= 1 adda.
2 addas	... ...	= 1 kuncham (320 tolas weight of rice).
20 kunchams	... ...	= 1 yedumu or kavadi.
2 yedumus	... ...	= 1 pandumu.
2 pandumus	... ...	= 1 palle putti (80 kunchams).
7½ palle puttis	... ...	= 1 garce (garisa of 600 kunchams or 192,000 tolas weight of rice).
1 bag or busta of paddy	...	= 166 lb.

Linear Measurement.

1 nulu	... .	= ⅛ inch.
2 nulu	... ...	= 1 pathika.

Land Measure (popular).

1 kuncham	... ...	= 10 cents.
1 yedum	... ...	= 2 acres.
1 pandum	... ...	= 4 acres.

KURNOOL.

Nandyal Taluk.

Weighment of Cotton.

Kapas—80 lb.	= 3 maunds.
63 Maunds ...	= 1 kantlam.
Seed—80 lb.	= 3 maunds.
45 Maunds	= 1 kantlam.

Lint is sold in candies of 500 lb.

Grain Measure.

32 Madras measures ...	= 1 thumu.
20 thumus	= 1 singam putti.
or	
64 Madras measures	= 1 thumu.
20 thumus	= 1 pedda putti (Nandyal putti.)

MALABAR.

Walluvanad Taluk.

Measurement for Grain and Liquids.

2 azhakus	= 1 ozhaku.
2 ozhakus	= 1 uri
2 uris	= 1 nazhi.
4 nazhis	= 1 edangali.
6 nazhis	= 1 narayam.
10 narayams	= 1 para.
24 nazhis	= 1 chottana.

Note.—One Madras measure = 7 nazhis : 1 narayam paddy weighs 90 rupees weight.

Linear Measurements.

8 ellummanies	= 1 thora.
8 thoras	= 1 viral.
24 virals	= 1 muzhakole or carpenter's kole.
2,000 muzhakoles	= 1 nazhika.
4 nazhikas	= 1 kathom.

Measurements by Timber Merchants.

576 perukams	= 1 candy.

WEIGHTS.

4 nellummanies	... ...	= 1 kunni.
2 kunnis	... ...	= 1 manjadi.
2 manjadis	... ...	= 1 panathookam.
10 panathookams	... ...	= 1 kazhanchu.
12 kazhanchus	... ...	= 1 palam.
100 palams	... ...	= 1 thulam.
20 thulams	.. ..	= 1 bharam.

NOTE.—Grain is measured struck. There are palams of different weights.

Bazaar drugs, 1 palam	...	= 5 rupees weight.
Jaggery and tobacco, 1 palam.		= 10 ,,
Pepper, ginger, sweet potatos, etc., 1 palam.	...	= 15 ,,

Ernad Taluk.

5 Walluvanad nazhis	...	= 1 edangali.
10 edangalis	... ...	= 1 para.
1 kole of sawed timber	...	= $\frac{1}{2}$ kole × 1 viral × 1 viral.
1 kole ...	... ...	= 2 ft. 3 $\frac{3}{10}$ in.

NOTE.—24 local virals make 1 kole.

Ginger is sold by the thulam of 35 lb. weight.

Chirakkal Taluk.

MEASUREMENTS FOR GRAINS.

4 nazhis	... ...	= 1 edangali or seer.
1 edangali	... ...	= 1 Madras measure very nearly.
10 edangalis or seers	...	= 1 para.
3 nazhis	... .	= 1 kongayi.
In the hills, 1 mada	...	=25 seers.

NOTE.—All are heaped measures.

LIQUID MEASURES.

6 small nazhis	... ...	= 1 kutti.
1 kutti ..	... ...	= 4 quart or big bottles.

Weights.

1 palam	= 9 rupees weight.
40 rupees weight	= 1 lb.
28 lb.	= 1 thulam.
20 thulams	= 1 bharam.

Tellicherry.

32 lb.	= 1 thulam.
20 thulams	= 1 bharam.

Cannanore.

30 lb.	= 1 thulam.
20 thulams	= 1 bharam.

NOTE.—In all the above three cases, 1 lb. = 40 rupees weight.

MADURA.

Weights.

6 tolas (·4114 oz)	= 1 palam (nearly 2½ oz.)
20 palams	= 1 viss.
6 visses	= 1 thulam (about 18½ lb.).
8 visses	= 1 maund (about 25 lb.).

Grain Measure.

1 heaped measure contains.	= 132 tolas rice.
4 measures	= 1 marakkal.
12 marakkals	= 1 kalam.

NILGIRIS.

Land Measure.

28 adis or country feet ...	= 1 kole = 24 English ft.
1 square kole	= 1 guli = 576 sq.ft.
100 gulis	= 1 cawni = 57,600 sq.ft. or 1·322 acres.
1 balla	= 3·82 acres = 166,464 sq. ft.
60 × 40 feet or 2,400 sq.ft....	= 1 manai or house-site.

Measures.

2 ollocks	=	1 ullock.
8 ollocks	=	1 padi or measure.
8 measures	=	1 marakkal.
5 marakkals	=	1 para.
400 marakkals	=	1 garisa.
50 jodis (i.e., double measures or 100 Madras measures).	=	1 palla.

Weights.

3 rupees weight (tolas)	=	1 palam.
8 palams	=	1 seer.
5 seers (3⅛ rattal) ...	=	1 viss.
50 palams (1¼ viss) ...	=	1 tuk.
8 visses	=	1 maund.
20 maunds	=	1 bharam or candy.

SALEM.

Measures.

2½ Madras measures ...	=	1 vallam.
40 vallams	=	1 kandagam.

The vallam varies up to 3 Madras measures.

Weights.

The tuku is used, but varies from 1¼ viss to 2½ visses according to the commodity.

2½ tukus	=	1 thulam.
16 thulams	=	1 sattai.
In Namakkal, 16 vallams.	=	1 moda.
6 modas	=	1 podi.

NORTH ARCOT.

Weights.

3 tolas	=	1 palam.
8 palams	=	1 seer (kaccha).
5 seers	=	1 viss.

2 visses	... ...	= 1 dhadiyam.
4 dhadiyams	... ...	= 1 maund.
20 maunds	... ...	= 1 candy.

The *pucka* seer of Chittoor and Vellore is 72 tolas.

Measures.

8 padis	... ...	= 1 marakkal or toom.
12 marakkals	... ...	= 1 kalam.
400 marakkals	... ...	= 1 garce.
40 kalams	... ...	= 1 candy.

The toom or marakkal differs in different places of the district.

Milk, curds and buttermilk are sold by measure.

Ghee, oils and honey are sold measure as well as by weight.

Land Measure.

1 kole or rod	... ...	= 24 feet.
1 square kole	... ...	= 576 square feet = 1 kuzhi (Tamil) or gunta (Telugu).
100 kuzhis or guntas	...	= 1 kani = 57,600 square feet = 1·32 acres Same as cawny of Tanjore.

SOUTH ARCOT.

Weights.

3 tolas	... ...	= 1 palam.
8 palams	... .	= 1 seer.
40 palams (5 seers)	... ...	= 1 viss.
50 palams	... ...	= 1 tuk.

12 palams and a fraction (varying in different localities) = 1 rattal (for indigo).

The 'French' pound is ·5 kilo. The groundnut candy is 240 kilos = 529·2 lb.

In the Salt Factories.

80 tolas	... ...	= 1 seer.
40 seers	... ...	= 1 Indian maund.
120 maunds	... ...	= 1 garce (4·39 tons).

GRAIN MEASURE.

(Officially recognized.)

132 tolas of rice	... ... =	1 heaped Madras measure.
2 Madras measures	... =	1 marakkal.

The marakkal however varies in size in different taluks though at all places 12 marakkals = 1 kalam and 24 kalams are generally held equal to a cartload. Near Palur, a kalam = 36 Madras measures and 12 kalams go to the cartload.

LIQUID MEASURE.

Usually as fractions and multiples of a Madras measure, ghee and oil are retailed by weight by the seer and palam above.

Arrack is sold by gallons and drams.

LINEAR MEASURE.

9 angulas (thumb's breadths)	=	1 jan (span).
12 ,, ...	=	1 adi (foot).
18 ,, ...	=	1 molam (cubit, length from elbow to tip of middle finger).
2 molams	=	1 gaja (yard).
2 gajas	=	1 mar (distance between tips of the two middle fingers measured across the chest with the arms horizontal).

LAND MEASURE.

24 feet	=	1 kole (rod).
1 square kole (576 sq. ft.) ...	=	1 kuli.
100 kulis	=	1 kani (1·32 acres).

SOUTH KANARA.

Mangalore.

WEIGHTS.

24 tolas	=	1 seer.
48 seers	=	1 maund.
20 maunds	=	1 candy.

GRAIN MEASURES.

1 pavu	= $\frac{1}{4}$ seer.
2 pavus	= $\frac{1}{2}$ seer.
14 seers	= 1 kalasikay.
3 kalasikays	= 1 muda.
42 mudas	= 1 korgee.

NOTE.—One muda paddy seed is generally 4 kalasikays.

LIQUID MEASURES.

1 kututhay	= 12 rupees weight.
9 kututhays	= 1 kutti.
2 kututhays	= 1 seer.
10 kuttis	= 1 maund.

Udipi—Liquids.

12 kudukthas	= 1 baylay.

Coondapoor.

1 sidhay	= $1\frac{1}{4}$ kututhay.
1 manikay	= 1 muda.

Bantwal side, Mangalore Taluk.

7 kuttis	= 1 samma mana or maund.
10 kuttis	= 1 thodda mana or maund.
4 doddays	= 1 maund.

MONEY AND GOLD.

1 varah	= 4 rupees.
1 duddu	= 4 pies
1 pie	= 2 chikas.
12 duddus	= 1 chakra = 4 annas.
2 chakras	= 1 chavala = $\frac{1}{2}$ rupee.

TANJORE AND TRICHINOPOLY.

WEIGHTS.

16 pies	= 1 palam or 3 tolas.
8 palams	= 1 seer.
5 seers	= 1 viss.
8 visses	= 1 maund.
20 maunds	= 1 candy.

Hides and leather are weighed in terms of a *rattal* of 1½ seers.

Vegetables, tamarind, etc., in terms of thukku or edai of 6¼ seers.

Measures.

2 local measures ...	... =	1 Madras measure.
2 Madras measures	... =	1 vellam.
2 vellams ...	... =	1 marakkal.
12 marakkals	... ... =	1 kalam.
5 kalams ...	... ... =	1 urai.
$2\frac{2}{5}$ urais ...	... ... =	1 bandy load of 12 kalams.
120 coconuts ...	... ... =	1 somai or load.
40 marakkals of onions	... =	1 podi or pack.

For measuring Oil, Ghi, etc.

8 ollocks ...	... ... =	1 Madras measure.
2 Madras measures	... =	1 kudam.
4 kudams ...	... ... =	1 adam.

N.B.—The kalam varies from 43 to 48 Madras measures in the district.

A small padi, of which four go to the marakkal, is still largely used by the ryot. A seer, one-fifth of a padi, is used for measuring milk, etc. The kalam itself varies from taluk to taluk.

TANJORE.

Land Measure.

144 sq. feet ...	... ... =	1 kuli.
100 kulis ...	... ... =	1 ma.
3 ma's ...	... ... =	1 acre.
4 ma's ...	... ... =	1 kani.
20 ma's ...	.. ... =	1 veli ($6\frac{74}{121}$ acres).

TRICHINOPOLY.

2 kulis ...	... ... =	1 acre.

TINNEVELLY.

Weights.

$5\frac{39}{64}$ rupees weight	... =	1 palam.
144 palams ...	... ... =	1 tulam (100 palams = 1 tulam in the south).
12 tulams ...	... ... =	1 pothi.
2 pothis ...	... ... =	1 candy (500 lb.).

1 tulam	= 20½ lb.
16 tulams	= 1 pothi in Rāmnād district.
12 tulams	= 1 pothi of seed.
16 tulams	= 1 pothi of Kappas – in cotton tracts north of Sattur.
72 palams	= 1 edai in cotton tract.
25 palams	= 1 edai in the south.
20 palams	= 1 edai in Srīvilliputtūr taluk of Rāmnād district.
4¼ palams	= 1 seer (Rs. 25 weight).

In the cotton tracts in the south 1 edai is equivalent to 10¼ lb.

Weights used for weighing Gold and Silver.

20 manchadis	= 1 kalanji.
$\frac{4}{5}$ kalanji	= 1 varagan idai.
$3\frac{5}{6}$ varagan idai	= 1 rupee weight = 1 tola.

Grain Measures.

2 half mahanis	= 1 mahani ($\frac{1}{16}$ measure).
2 mahanis	= 1 ollock ($\frac{1}{8}$ Madras measure).
2 ollocks	= 1 ullock ($\frac{1}{4}$ Madras measure).
2 ullocks	= $\frac{1}{2}$ Madras measure.
4 ullocks	= 1 nali (1 Madras measure).
1½ seers...	= 1 Madras measure.
96 Madras measures	= 1 kottai (Koilpatti tract).
112 Madras measures	= 1 do. (in Tinnevelly).
120 Madras measures	= 1 do. (Rāmnād district).
4 Madras measures	= 1 marakkal.
48 Madras measures	= 1 kalam.

In some parts of Rāmnād—

3 Madras measures	= 1 marakkal.
90 Madras measures	= 1 kottai.

LAND MEASUREMENT.

Wet Land.

8 seer padi	... ... =	1 marakkal (nearly 8 cents).
21 marakkals	... ... =	1 kota (163 cents).

Dry Land.

21 kurukkams is the aea which can be ploughed by one pair in a day.

8 kurukkams	... ... =	1 sangili.

or—

3 Madras measures	... ... =	1 marakkal.
30 marakkals	... ... =	1 kottai.
12 marakkals	... ... =	1 acre.

VIZAGAPATAM.

WEIGHTS.

2 chatakas ...	= 1 nantak	=	$1\frac{1}{4}$ oz.
8 nantaks ...	= 1 seer	=	10 oz.
5 seers ...	= 1 visam or viss ...	=	$3\frac{1}{8}$ lb.
8 visams ...	= 1 manugu or maund	=	25 lb.
8 manugus ...	= 1 kantlam	=	200 lb.
20 manugus ...	= 1 putti or candy ...	=	500 lb.

The following table is also used side by side with the first :—

2 yebalams ...	= 1 padalam	=	$1\frac{1}{2}$ lb.
2 padalams ...	= 1 visam	=	3 lb.
8 visams ...	= 1 manugu	=	24 lb.
8 manugus ...	= 1 kantlam	=	192 lb.
20 manugus ...	= 1 candy	=	480 lb.

GRAIN AND LIQUID MEASURE.

4 giddas ...	= 1 sola	=	...
2 solas ...	= 1 tavva	=	$2\frac{1}{8}$ pints.
2 tavvas ...	= 1 adda or manika.	=	$4\frac{1}{4}$ pints.
4 addas ...	= 1 kuncham ...	=	17 pints.
20 kunchams.	= 1 buri putti (in Kondakerla firka).		
80 kunchams.	= 1 pedde putti (in rest of taluk).		
600 kunchams.	= 1 garisu (garce).		

OTHER WEIGHTS AND MEASURES.

Cotton.

1 skein	=	120 yards.
7 skeins	=	1 hank.
18 hanks	=	1 spindle.
The number of hanks to 1 lb. ...	=	"counts."

Angular Measure.

60 seconds (″)	=	1 minute (′).
60 minutes	=	1 degree (°).
90 degrees	=	1 right angle.

Metrical System.

Linear Measure.

10 millimetres	=	1 centimetre.
10 centimetres	=	1 decimetre.
10 decimetres	=	1 metre.
10 metres	=	1 decametre.
10 decametres	=	1 hectometre.
10 hectometres	=	1 kilometre.
10 kilometres	=	1 myriametre.
1 millimetre	=	·039370 inch.
1 metre	=	3·28084 feet.
1 kilometre	=	·62137 mile.

Square Measure.

1 hectare = 1 square hectometre = 2·4711 acres.

Weights.

1 gramme	=	·03527 oz. (Avoirdupois).
1 kilogramme	=	2·20146 lb. (Avoirdupois).

Dry Fluid Measure.

1 litre	=	·21998 gallons.

The metrical system is based on the *metre* which is the ten millionth part of the quadrant of a terrestrial meridian. The *litre* is the cube of the tenth part of the *metre*, and the weight of a *litre* of distilled water at its greatest density is a *kilogramme*.

USEFUL NUMBERS.

For converting	Multiply by	Converse.
Linear.		
Feet into links	1·5151	·66
Yards " "	4·545	·22
Chains " miles	·0125	80
Feet " metres	·3048	3·2809
Yards " "	·9144	1·0936
Chains " "	20·117	·049
Square.		
Square yds. into sq. metres ...	·8361	1·196
Square " " acres	·0002066	4,840
Square miles " "	640	·001562
Capacity.		
Cubic ins. into bushels	·00045	2,219·7
Cubic ft. " "	·778	1·285
Cubic " " gallons	6·228	·1605
Cubic " " Madras Measures.	16·0	·0625
Gallons " litres	4·543	·220
Litres " cub. ft.	·03532	28·33
Weights.		
Lb. into cub. ins. of water ..	27·74	·036
Lb. " " ft. " ...	·01605	62·2786
Cubic ft. of water in tons ...	·0278	35·9
Lb. into kilogrammes	·4536	2·2
Money.		
Dollars into Rs.	3·1245	·32
Francs " "	·58665	1·70

MENSURATION AND SURVEYING.

Area of rectangle = length × breadth.

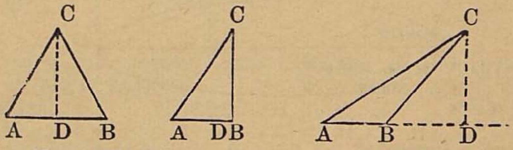
Area of square = any side × itself.

Area of parallelogram = base × perpendicular height.

Area of trapezoid = half the sum of the parallel sides × perpendicular height.

Area of trapezium or any quadrilateral = sum of the two triangles of which it is composed.

Area of triangle = half the product of the base into the perpendicular height or $\frac{AB \times CD}{2}$.



or if s = half the sum of the three sides a, b, c, the area = $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$

(a) Area of a circle = diameter^2 × ·7854.

To multiply by ·7854, multiply by 7 and then by 2 moving the rows one place to the right, as shown below :—

865			
7			
6055	...	...	7
6055	...	...	7
12110	...	...	14
12110	...	...	14
679·3710	...	...	7854

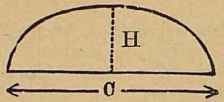
The circumference = twice the radius × $\frac{22}{7}$ or the diameter × $\frac{22}{7}$

(b) Area = circumference × half the radius or if r = the radius, area = $2\,r \times \frac{22}{7} \times \frac{r}{2} = \frac{22}{7} r^2$

(c) Area = (the circumference)^2 × ·08.

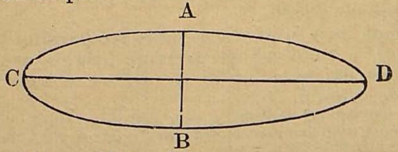
Area of a sector of a circle = length of the arc × half the radius.

Area of segment of a circle—



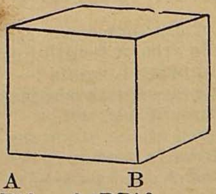
$$\text{Area} = \frac{4H}{3}\sqrt{\tfrac{1}{4}c \times \frac{2H^2}{5}}$$

Area of an ellipse—



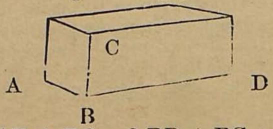
$$\text{Area} = \frac{AB}{2} \times \frac{CD}{2} \times \frac{22}{7}$$

Cube—



Surface $= 6\,(AB)^2$ or $6\,(BD)^2$
Volume $= (AB)^3$ or $(BD)^3$

Rectangular solid or parallelopiped—



Surface = 2 AB + BC + 2 BD + BC + 2 AB, BD.
Volume = AB × BD × BC.

Solid cylinder—
Surface = area of both ends + length × circumference.
Volume = area of one end × length.

Solid cone or pyramid—

Surface of cone = area of base + circumference × ½ the slant height.

Surface of pyramid = area of the base + areas of the side triangles.

Solid content = area of the base × one-third of the perpendicular height.

Sphere—

Surface = diameter² × 3·14159

Solid content = diameter³ × ·5236

Wedge—

Solid content = area of base × ½ perpendicular height if all the edges are equal.

A *Prismoid* is a solid whose ends are parallel but unequal in area, e.g., a bund whose extreme heights are unequal, a cutting whose extreme depths are different, a gravel heap on the roadside, a pond, etc.

NOTE.—A prismoid includes a cone and a pyramid: but if the ends besides being parallel are also equal and similar so that the solid is uniform from end to end it is a prism.

Solid contents of a prism = area of one of the parallel ends × height or depth or length.

The solid contents of a prismoid may be calculated in three ways—

(*a*) Average of extreme areas × length (or height).
(*b*) The middle area × length (or height).
(*c*) By the following formula :—

h = distance between the parallel ends.
A_1 = area of one end.
A_2 = area of the other and parallel end.
A_m = area of a section taken midway between A_1 and A_2 and parallel to them.

Solid contents $\frac{h}{6} \times (A_1 + 4\,A_m + A_2)$—

(*a*) Always gives more than the real volume and may be used for making estimates, so as to be on the safe side.

(*b*) Always gives less than the real volume and is used for measuring heaps of road metal stored by contractor.

Example.—A metal heap has a rectangular base 14′ × 6′ and a rectangular top surface 10′ × 2′ with a height of 2′. Find its volume.

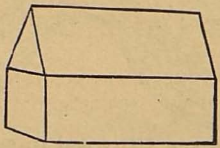
(*a*) $\frac{84 + 20}{2} \times 2 = 104$ cubic feet.

(*b*) $12 \times 4 \times 2 = 96$ cubic feet.

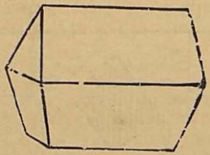
(*c*) $\frac{84 + 4 \times 48 + 20}{6} \times 2 = 98{\cdot}6$ cubic feet.

Contents of a stack.—There are two general types of stacks.

(i)



(ii)



(i) A rectangular parallelopiped and a prismoid.
(ii) Two prismoids.

The weight of straw per cubic yard in the stack varies with the nature of the straw and the length of time it has been in the stack, and the position from which it is taken. Old straw is heavier than new straw and if taken from the bottom of the stack weighs more than that from the top.

Weight of straw and examples.—The weight of cholam and paddy straw in the stack is about 124 lb. per cubic yard. The weight of a stack of hay made at Coimbatore was only 88 lb. per cubic yard.

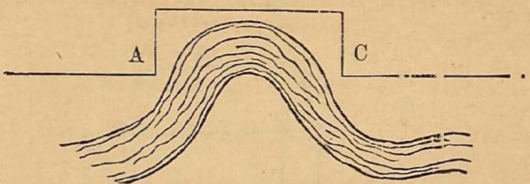
At these rates the hay will measure 25 cubic yards to the ton, and the straw, 18 yards.

To set out a right angle with the chain.

Take 40 links on the chain, 30 links for the perpendicular and 50 for the hypotenuse.

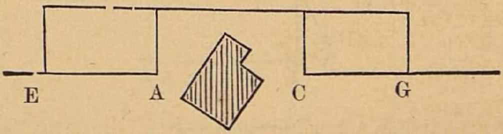
Obstacles in ranging survey lines.

1. Seen over and chained round.



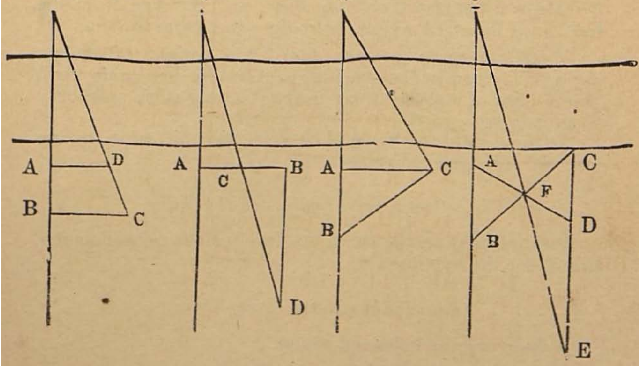
Lay off AB and CD equal to each other and at right angles to the line, then AC = BD.

2. Not seen over but chained round.



Lay off the lines EF, AB, equal to each other, and at right angles to the line; range the points D, H, in line with FB, and set off the lines DC, HG, equal to AB and EF, and at right angles to the line FH, then C and G are points for ranging the continuation of the line EA, and AC = BD.

3. Seen over but neither chained across nor round.



By figure 1—

Measure off perpendiculars BC, AD ranging D in line with OC.

$\frac{OA}{AD} = \frac{OB}{BC}$; $OA \times BC = AD \times (OA + AB) = AD \times OA + AD \times AB$; $\therefore$ $OA\ (BC - AD) = AD \times AB$ or $OA = \frac{AD \times AB}{BC - AD}$.

By figure 2—

Measure AB at right angles to AO and bisect AB at C. Set off BD at right angles to AB until at D, C hides O.

Then $AO = BD$.

By figure 3—

Set off AC at right angles to AD and CB at right angles to CO.

Then $OA \times AB = AC^2$

Therefore $OA = \frac{AC^2}{AB}$.

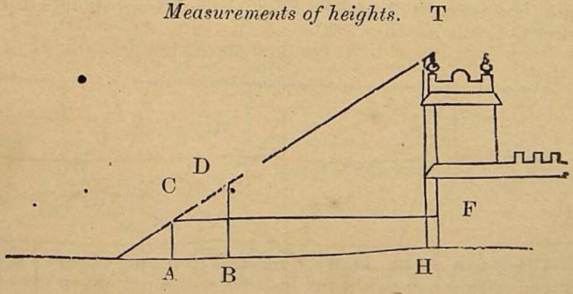
By figure 4—

Fix any line AD and bisect it at F.

Make $BF = FC$. Produce CD until at E, F hides O.

Then $AO = DE$.

Measurements of heights.



Fix two rods AC, BD, of unequal height vertically as shown so that C, D and T are in one line. Measure AB and BH.

Then $\frac{TF}{FC} = \frac{DE}{EC}$ or $\frac{TF}{AH} = \frac{DE}{AB}$

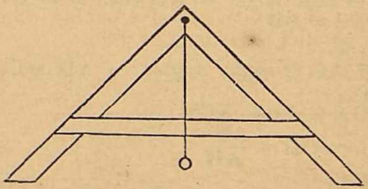
$TF = \frac{DE \times AH}{AB}$.

The height of the tower = TF + AC.

Or plant any stick vertically and measure its shadow ; at the same time measure the shadow of the object whose height is required.

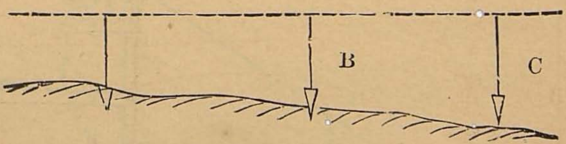
$$\text{Then } \frac{\text{Height of object}}{\text{Its shadow}} = \frac{\text{Height of stick}}{\text{Its shadow}}.$$

Simple methods of levelling.



A line at right angles to the plumb line is horizontal.

After driving a few pegs on one level with a bricklayer's level, a peg at a distance on the same level may be driven with the help of *boning rods* or any three sticks of one height.

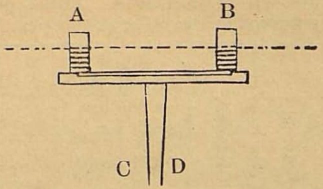


Place two of the sticks over the extreme pegs A and C driven with a mason's level and drive the peg B so that the third stick placed over it is in line with the tops of the other two. Intermediate pegs may similarly be got on the same level.

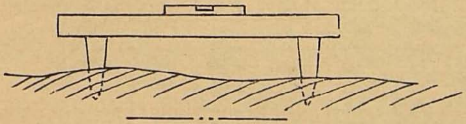
The pegs may also be driven on any required gradient. If AB is 3 feet, place upon B a small plank 1 inch thick and level. The gradient from A to B will then be a gradient of 1 in 36 and so on.

2. Liquids in communicating vessels are on a level.

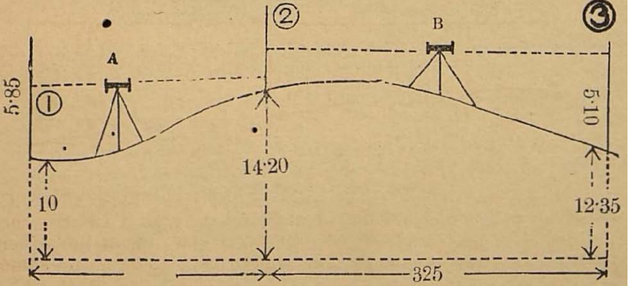
A and B are two glass vessels or bottles connected by a tube AB, containing some coloured liquid and mounted on a stand CD.



3. Instead of a mason's level a bubble tube placed on a plank with parallel edges may be used.



The following simple example shows the use of the Dumpy level.



It is required to find the difference in level between stations (1) and (3). Erect the spirit level at A and take the "backsight" reading on the staff at (1) and the "foresight" on the staff at (2). Then move the level to B and repeat the

same for (2) and (3): the distance between the stations is also to be measured. These observations are entered in columns in the book as follows:—

Station.	Distance.	Staff readings.		Rise.	Fall.	Reduced level.	Remarks.
		Back-sight.	Fore-sight.				
1	...	...	...	...	...	10	Datum line below station 1.
2	155	5·85	1·65	4·20	...	14·20	
3	325	3·25	5·10	...	1·85	12·35	
	478	9·10	6·75	4·20	1·85	12·35	
		6·75		1·85		10	
		2·35		2·35		2·35	

Thus there is a fall of 2·35 feet from (3) to (1) (distance, 478 feet) or 5·9 inches nearly in 100 feet.

BUILDINGS AND ROADS.

Lime absorbs water, or water may be added, when it is called *slaked lime.*

A para of lime is the quantity contained in a box 22 inches square and 10 inches deep (inside measurements), and is thus approximately 2·8 cubic feet. It weighs 60 lb.

2 paras = 1 salagai.

A cart-load of lime will be from 10 to 12 paras, i.e., about 30 cubic feet. When slaked this will occupy about twice the space, i.e., 60 cubic feet.

Mortar for concrete :—1 part of lime to 3 of sand : for building and plastering : 1 part of lime to 2 of sand.

The value of mortar is equal to the volume of sand used : thus 10 paras of sand + 5 paras of lime will give 10 paras of mortar. Twelve paras of mortar will be required for building 100 cubic feet of brick in mortar.

Bricks.

Table moulded bricks :— 9″ + 4″ × 2¼″.
Country bricks :— 8″ × 4½″ × 2¼″.

For 100 cubic feet of building 1,200—1,300 table moulded bricks are wanted, or 1,500—1,700 country bricks.

One cart-load of bricks contains 300 table moulded or 430 country bricks.

Four masons, with four women to assist, will build 100 cubic feet of straight wall in a day : if scaffolding is necessary, the figure may drop to 60 cubic feet.

Surki concrete :—2 parts of mortar to 4 or 5 parts of broken bricks.

One woman will break ⅔ cubic yard of bricks for concrete in a day.

One mason, with a woman to help, will rough plaster 150 square feet in a day. If the work is properly finished 100 square feet only will be done.

One Madras Measure of lime, mixed with water, will be sufficient for whitewashing 100 square feet, single coat. For second coat half the quantity.

One woman will cover 300 square feet in a day, single coat, 200 square feet double coat.

Metalling Roads.

One man can pick up 500 square feet of metalled road in a day, if the surface be thoroughly soaked : this will drop to 350 square feet if conditions are not so favourable.

For spreading metal, labour may be employed as follows :—3 men filling baskets, 6 women carrying, 1 man taking and emptying baskets, and 2 men sectioning : such a gang will, if the metal is already in heaps on the side of the road, cover 3,000 square feet a day.

[From U.S.A. Bulletin 463.]

Width of roadway in feet.	Area in square yards per mile of length.	Cubic yards of surfacing material required for each 1 inch loose depth per mile of length.
8	4,693	130·3
10	5,866	162·9
12	7,040	195·5
16	9,386	260·6
20	11,733	325·8

To move one ton gross load on a well constructed cart.

	LB.
Loose sand road	315
Earth road, average (dry)	150
Good earth road	100
Gravel road	80
First-class metal road	55

MACHINERY.

Nominal horse-power (N.H.P.) is a general or vague term used to indicate the size of the engine and means the power given out when worked at a pressure of about 30 lb. to the square inch.

Indicated horse-power (I.H.P.) refers to the total power exerted on the piston by the steam or the exploding gases in the cylinder as tested by an indicator. It is usually $2\frac{1}{2}$ times the 'nominal.' Brake or effective horse-power (B.H.P.) is the net useful work transmitted by the driving shaft through a band which acts as a 'brake' to the motion of the fly wheel. It represents the ordinary working power of an engine, and runs about $\frac{3}{4}$ of the I.H.P., or $1\frac{1}{2}$ times the N.H.P.

One horse-power = raising 33,000 lb. one foot high in one minute or = 33,000 foot pounds = 33,000 units of work. The heat unit, i.e., the energy required to raise 1 lb. of water 1° Fah. is 744 ft. lb., to raise 1 lb. of water 1° C. requires 1,390 ft. lb.

1 lb. of coal yields 14,000 heat units.
1 lb. of kerosene oil yields 20,000 heat units.

The modulus of an engine is the proportion of motive power which is given out as useful work: in ordinary farm machines it is about a half, the other half being used up in overcoming the resistance of the machine itself.

In an oil engine about 60 per cent of the heat is dissipated by the cooling jacket, 25 per cent escapes by the exhaust and only about 15 per cent are ultimately available for transmitting power to other machinery.

Half a pint of oil is supposed to be required for B.H.P. per hour.

WATER LIFTING.

Water lifted in one hour by various machines.

Picottah (3 men—2 on beam) ...	14 ft.	2,735 gallons.
Mhote	38 ft.	1,523 ,,
Oil engine : 3″ pump and $3\frac{1}{2}$ H.P. engine.	25 ft.	12,800 ,,

The co-efficient of utility is the amount of useful work done in one hour, expressed in foot pounds, divided by the weight of the animal in pounds, and represents the vertical

height in feet to which by the expenditure of a similar amount of work, the animal's body would be raised.

—	Duration of time of experiment.	Foot-pounds of work done per hour.	Weight of animals.	Co-efficient of utility.
	MINUTES.			
Double mhote Saidapet.	180	413,000	1,146	360
Stoney's improved double mhote.	367	1,709,300	1,146	498
Subba Rao's improved single mhote.	60	500,940	1,348	371
Single mhote Bellary lift of 35 feet.	102	1,337,000	2,688	497
Single mhote Bellary lift of 13 feet.	165	456,400	2,058	222
Picottah	16	375,810	308	1,220
Do.	420	394,310	331	1,191

[Table from Madras Agricultural Department Bulletin 35, by Sir A. Chatterton.]

Amount of water lifted one foot for 1 anna.

By bullocks in country mhote (1882: Benson)	4,000
By bullocks in country mhote: (1907: Chatterton).	2,000
By oil-engine and pump: under very favourable conditions.	13,500
By oil-engine and pump: under ordinary conditions.	9,000
By oil-engine and pump: under unfavourable conditions,	4,000

The loss of power in a centrifugal pump ranges from 75 per cent for a 2″ suction pipe to 60 per cent for a 3″ suction pipe and 45 per cent for a 10″ or 12″ pipe.

A 3″ pipe will lift up to 22 feet easily and a 4″ pipe will lift up to 28 feet.

The larger the installation the more economically the engine can be run, owing to the increased efficiency of the engine, and the proportionate saving in the establishment.

Actual cost of installations.

Name of station.	Engine.			Pump.			Storage of oil.	Foundations.	Engine shed.	Belting.	Miscellaneous—including circulating cistern and fitting charges.	Total.
	Brake horse-power.	Cost of engine.	Cost of fittings.	Size of pump.	Cost of pump.	Cost of fittings.						
Kuhoor	3½	965	150	3″	285	93	30	40	30	50	82	1,725
Unjalur	5	1,286	77	3″	270	145	20	50	35	31	86	2,000
Bangalaputtur ...	7½	1,546	101	4″	345	165	30	50	35	40	118	2,430
Nellikuppam ...	9	1,794	93	4″	365	128	30	80	50	40	130	2,710
Pallavaram ...	14	2,474	180	5″	450	...	30	80	200	81	175	3,670
Katalai	25	4,423	730	12″	1,265	445	150	200	750	123	404	8,490

Vide Appendix to "Lift Irrigation," by Sir A. Chatterton.

3

Duty of water.

The duty of water is the irrigation work which a given quantity of water can perform and is usually shown as the number of acres on which a crop can be irrigated by a continuous flow of water at the rate of 1 cubic foot per second. The duty of water when used to cultivate paddy is much less than when irrigated dry crops are grown. For tank irrigation which is generally wasteful, the duty may be taken as 50 acres: in large irrigation systems, where the water is under proper control, the duty will be as high as 100 acres. For water lifted from wells by engines and pumps the duty may be taken as 240 acres; actual experiment at Coimbatore with water lifted from wells gives 280 acres. At Cawnpore where sugarcane needed 50 acre-inches of water, the duty is 171; for wheat 347 and for maize 192.

Amounts of water needed for irrigated crops.

(Exclusive of rainfall.)

Crop.	Duration.	Inches.
Paddy	5 months	37
Ragi, monsoon crop	3 "	9
Ragi, hot weather	3 "	13
Cholam	4 "	10
Sugarcane (Cawnpore)	12 "	50
Maize (do.)	4 "	15
Wheat (do.)	4 "	8

Water data.

1 cubic foot water = 62·425 lb. = ·557 cwt. = ·028 tons.
1 cubic inch = ·03612 lb.
1 gallon = 10 lb. = ·16 c. ft. = 277·274 cubic inches.
1 cubic foot = 6·25 gallons ($6\frac{1}{4}$ gallons).

Gauging water.

1. Through a sluice or submerged opening.

$$Q = A \times V = A \times 5\sqrt{H}$$

where Q = quantity in cusecs (c. ft. per second).

A = area in sq. feet of the opening through which the water passes.

H = height of water in feet above the centre of the opening.

Q × 375 = gallons per minute.

V = Mean velocity of water approaching the opening in feet per second.

2. Over a weir or plank, free overfall.

$Q = H \times L \times V$

where H = height of still water above crest in feet.

L = length of crest in feet.

V = mean velocity of water approaching the crest in feet per second $= \frac{2}{3} \times 5 \sqrt{H}$.

Q = quantity discharged over the crest in c.ft. per second.

In gauging, the water must all be made to pass over a rectangular aperture in a thin board. The height must be measured from the top of the crest to the level of the surface where it is not affected by the curve of the overfall.

Storage.

It is usual to assume that an acre of crop will require an acre-fathom (6 ft.) of storage in a tank if the latter is the source of supply. Rain is required to supplement this supply as also to make up for the loss due to evaporation which may be taken as ·4 inch as a maximum figure on a very hot day. It is less proportionately in deep tanks than in shallow ones.

Capacity of a tank may be roughly taken to be = area of waterspread at F.T.L. (full tank level) $\times \frac{1}{3}$ of the depth of the lowest sluice.

Velocity and discharge of minor irrigation channels.

The average velocity of water flowing in a channel may be taken as of 4/5 the surface velocity which may be easily ascertained by means of a float floated down a measured distance. The average velocity of an earthen channel should ordinarily be more than one foot per second and less than three feet per second. If less than one foot per second there will be a free deposit of silt and the channel will be choked with aquatic plants. If more than three feet per second, the water will cut its own banks and bed and take a new course.

The velocity of a channel depends upon the depth of water flowing as well as the fall of bed. If the depth is great as in large rivers, the bed-fall will have to be small so that the velocity may not exceed about three feet per second. In small channels where depth is limited the bed-fall will have to be great to secure the proper velocity. The bed-fall is usually half to two feet per mile in large rivers, five to ten feet per mile in canals, and 20 to 25 feet per mile in very small channels, 25 feet per mile = 1 in 211 or say 1 in 200.

For small masonry channels where friction is less and therefore velocity greater, a fall of 1 in 300 or 400 may be given.

Discharge of channel = A × V cusecs, where A = area of cross section of stream in square feet and V = average velocity in feet per second.

Draught of carts.

The force of traction of a cart along a level fairly metalled road is about 1/21 of the weight of the cart with load. To move a loaded cart weighing one ton, with the wheels well greased along such a road, will require 107 lb.

Up a gradient of 1 in 100 the draught will increase by 1/100 of a ton, i.e., 22·4 lb. = total 129 lb.

Weights and draughts of various implements.

	Weight.	Draught.
	LB.	CWT.
Country plough	50	2½
Sivagiri plough	50	2½
Meston plough	36	2½
Monsoon plough	60	3
Sabul plough	120	3½
Howard plough	110	5
Steel Eagle plough... ...	135	6
Gallows plough	250	6
3 furrow S.E.E.D. plough.	300	3½
Double disc plough. ...	1,000	7
Flexible harrow	240	3
Disc harrow	1,500	7–12
Cambridge roller	1,500	4
Buck scraper (empty) ...	430	..
Do. (full) ...	...	11
Junior hoe	55	1½
Martins cultivator	440	...

LABOUR.

Cane harvesting.—For cutting 10 cents of cane 9 to 12 men will be needed. For cleaning, stripping, topping and bundling 10–14 women. Carrying will depend on the lead. At 20 tons to the acre of cleaned cane, there will be 2 tons from 10 cents ; this will be crushed by a three roller mill with two good pairs of animals, working in shifts in 12 to 14 hours. The juice from this will be 2,800—3,000 lb. One man to feed canes, one boy to drive, one boy to remove megass and help generally. A pan holds about 400 lb. and will give about 90 lb. of jaggery.

Carting *manure.*—Two carts, one left for loading while the other goes to the field, one pair of cattle, one driver and two men loading will fill and take to field ten carts per day with a lead of not more than half mile.

Carting silt.—The same as above, but one man for loading may be enough.

Clearing, heaping and burning scrub jungle for *modan* paddy. Malabar :—Five men and five women per acre.

Clod crusher.—The area worked by this daily depends on the state of the land, i.e., the size and hardness of the clods, and will vary from 1 acre with two pairs and a loaded crusher, to 3 acres with single pair in light land.

Cotton ginning.—One woman will beat and gin 25 lb. of cotton per day. Tinnevelly :—One woman gins 3 edai or 31 lb. in a day.

One man will keep about 12 ginners (on piece work) supplied for a day.

A double roller gin will clean from 2,000 lb. to 2,500 lb. of ordinary cotton in a day's work of ten hours. Nadam cotton is harder to gin and only about 1,500 lb. will be put through in a day, while with Cambodia as much as 3,000 lb. per day may be finished. A gin will clean about 1,680 lb. of Kapas of Red Northerns and N 14 cottons and about 2,000 lb. of Herbaceums and White Northerns in a day.

Crowbarring.—Thirty-three to forty men working in gangs of two, one digging and the other turning over clods, will dig one acre a day.

Digging *wet land with mamuty.*—In Tanjore district 12 men per acre for first digging ; 8 men after first puddling. At Coimbatore it takes 16 men.

Cultivating.—The Martin's cultivator at Coimbatore with two pairs of cattle covers 4 to 5 acres per day.

With the gorru worked as a cultivator, 3 to 4 acres a day.

Working guntaka.—With a 3-foot blade, a man can cover 4 to 5 acres per day.

(i) With Pedda guntaka (Black cotton soil previously ploughed with B.C.S. plough) four pairs of cattle and four men will cover one acre per day.

(ii) With ordinary guntakas weighted and worked deeply: one man and one pair will cover 2 acres per day; if worked merely for the purpose of creating a mulch and removing weeds, 3 to 4 acres may be covered according to the weediness of the land.

(iii) With guntaka to cover seed: with a 4-span guntaka 4 acres will be covered; if two are fixed to one yoke and a boy used to guide, from 6 to 8 acres will be covered per day.

(iv) With guntaka to remove cotton or jonna stubble, about 1 acre will be cleared per day.

Chaffing fodder.—This depends mainly on the length into which the fodder is cut. One man will cut 840 lb. of cholam fodder per day into pieces 24 inches long. With 8-inch machine needing 2 horse-power to drive it 8,000 lb. of cholam fodder can be cut in a day of 8 hours into lengths 1½ to 2 inches long.

Drilling.—A team consists of one pair with three-tined gorru, tines 10 inches apart, one pair with guntaka, two drivers and one or two women (if mixed crop) and they will drill 2½ acres a day, working the guntaka before and after the drilling. If the seed is drilled on the unworked land, one guntaka will keep pace with two gorrus.

(i) *Two-tined gorru.*—Used for cotton with tines 1½ feet apart. One man to drive, one boy or woman to sow, will do 4 or 5 acres in a day.

(ii) *Three-tined gorru.*—Used for jonna, one man to drive and sow, one boy to weight when needed and one pair, 3 or 4 acres per day. Used for cotton (as in Kurnool), the middle tine plugged, the boy may be dispensed with, and the area turned out will be 4 acres.

(iii) *Six-tined gorru.*—With another man to sow, and the same labour as shown for the three-tined gorru used for jonna, double the area may be turned out. Usually the implement needs to be weighted.

(iv) *Plough and akkadi.*—One pair and two men (1 for plough, 1 for akkadi) about 1 to 3 acres will be sown per day according to the crop sown.

(v) *Gorru and akkadi.*—(As for cotton in Bellary district) one pair of cattle and one driver, and a cooly for each akkadi, 3 to 4 acres will be sown in one day.

Jonna.—Six tyned gorru with tynes 10½″ apart 1 driver and 1 sower with 1 pair of bullocks will cover 6 to 8 acres per day.

Cotton.—Three tyned gorru with tynes 1′ 8″ apart with 1 driver and 1 sower with 1 pair of bullocks will cover 3 to 4 acres per day.

Bengal gram.—Three tyned heavy drill with tynes 1′ apart 3 to 4 pairs of bullocks with three drivers, 1 sower and 1 man for weight will cover 1 to 1½ acres per day, sowing being done deep.

Groundnut.—Either 6 tyned drill with two hoppers or three tyned drill with one hopper (tynes 10½″ apart) will cover 6 to 8 acres or 3 to 4 acres, respectively.

Dry paddy.—One big pair with six tyned gorru and one small pair with four tyned gorru will cover 4 to 6 acres and 3 to 4 acres, respectively per day.

Extracting fibre—*Agave fibre.*—One man and one woman will extract 50 lb. of dry fibre in a day from fresh leaves.

Coir fibre.—A woman can beat out 25 lb. of coir fibre per day.

Gogu.—Cutting or pulling crop, 10 women or 10 men. Bundling, 6 women per acre. Retting, 2 men will arrange the bundles and weight them off one acre (20,000 lb.), while in stripping, 3 men will supply stalks to 30 women or boys who will strip the above amount and produce 800 lb. of dry fibre per acre.

Sunnhemp.—The fibre is obtained by beating the retted stalks in water. Forty men will cut and beat the produce of one acre (15,000 lb. of green stalks) and obtain 600 lb. of dry fibre per day.

In Tinnevelly reaping the crop and bundling Rs. 4 per acre.

Grinding—*Cotton seed.*—This may be done wet as in Coimbatore where a woman or boy will do 7 lb. per hour, i.e., 50 lb. per day, enough for 17 animals, or dry as in Ceded districts where two boys sitting on either side of large stone will crush 100 lb. per day.

Harrowing—*Brush harrow.*—A number of branches (weighted) drawn by a pair ; covers an area of 5 to 6 acres of a sown field.

The Sampson harrow works $2\frac{1}{2}$ to 3 acres a day in open fields or if the crop is not too high.

Seed harrow covers about 5 to 6 acres a day.

Harvesting—*Bengal gram.*—This is pulled out of the ground and needs 5 to 6 women per acre. Contract rate about Rs. 1-12-0 per acre.

Cholam.—Three women will cut the crop off an acre and 5 women will remove the heads. The heads (850 lb.) of an acre will fill 1 or $1\frac{1}{4}$ carts, and 1 man and 2 boys will be needed to load and remove to the floor. Bundling and stocking is generally done by men and needs per acre 4 men. The straw [4,000 lb.] of an acre will fill four carts. Cutting stalks with earheads—8 Madras Measures per acre, cutting earheads from stalks—8 Madras Measures per acre. (These two operations are generally done on contract.)

Fodder cholam.—One woman will cut and bundle 1,000 lb. a day.

In Tinnevelly, on black soils, 2 men and 8 women will cut and bundle 1 acre of fodder cholam, i.e., about 1 ton.

Cotton picking.—In a heavy crop 1 woman will pick 25 to 30 lb. but in a poor crop the quantity may be as low as 10 lb. and in the last picking as low as 6 to 7 lb.

In Cambodia cotton, as much as 100 lb. per day may be picked by a woman in a good season.

Cumbu.—Twelve to twenty women for cutting earheads and 6 to 8 women for cutting straw, depending on the size of the crop.

Removing cotton stalks.—Four to five men will clear an acre. (*See* Guntaka above.)

With the cotton puller (LEAFLET XIX of 1911) the work can be done in the dry weather by 5 women or less per acre.

Groundnut.—In South Arcot, the land is dug over by 12 to 15 men with the mamuty and 5 women to each man collect the nuts, i.e., 75 to 80 women per acre. A rainfed crop may be ploughed with a country or special plough and the nuts collected by hand, if the land is sandy. In the Deccan the plants are heaped after working the guntaka by 4 to 5 men per acre. Picking pods from heaped plants costs 2 to 2 annas 3 pies per kerosene tin. Picking pods out of ground costs 4 to 6 annas per kerosene tin.

Sweet potatos.—Forty men to dig and 30 women to turn over and collect the vines and tubers.

Onions.—Digging, lifting, carrying and cleaning 10 men and 60 women.

Other pulses.—The crop will be picked over two or three times and may need each time 4 to 5 women per acre.

Paddy.—Cutting, bundling, carrying, threshing and winnowing grain—8 men per acre, cattle threshing and winnowing, including carting the straw. Second operation—5 men per acre with owner's cattle.

Ragi.—Twelve to sixteen women to cut heads off an acre on two occasions and 6 to 8 women for cutting straw.

Tenai.—In Ceded Districts for a mixed crop of Korrapathi, 6 women per acre. For a pure garden crop 10 women per acre.

Tobacco harvesting—Four men will harvest an acre in a day cutting the leaves off the stalks ; 2 men and 10 women will carry and stack the produce.

Stripping and bundling.—Six men and twelve women drying, and heaping 6 men. Finally 8 men and 12 women will open, sort and rebundle leaves and sprinkle salt water on them.

Turmeric.—Sixteen men for digging an acre and 70 to 80 women for picking (i.e.), 4 to 5 women per man.

Husking—*Paddy.*—Two women should finish a selagai (160—170 lb.) in 5—6 hours. They may do as much as 1½ selagais per day. A cooly of paddy, i.e., one day's work is 16 Marakkals for which 1½ M.M. are given. Eight annas per thumu of 32 Madras measures.

Interculturing—*Bullock hoeing.*—With dantulu, about 2 acres for each danta, i.e., for three, 6 acres per day, for four, 8 acres a day. In the Ceded Districts it is not uncommon to cover 9 to 10 acres in a day.

(i) By hand, usually combined with weeding. For a fairly clean field of jonna, 3 to 10 coolies will cover 1 acre, a weedy field will take up to 40 per acre depending on the weediness.

(ii) *Cotton with guntaka.*—One man and a pair, 3 acres per day.

(iii) With a plough from ¾ to 1 acre per day.

Planting—*Canes.*—Six men and ten women will cut, strip, carry and plant an acre in a day using 10,000 to 12,000 sets. If the rate is 20,000 to 25,000, 10 men and 16 women will be needed.

Coconuts—

Digging 80 pits per acre	40 men
Manuring	20 ,,
Planting	4 ,,

Kiluvei hedge.—One man can do 16—30 yards fence a day depending on thickness of hedge, and his skill. Twenty cuttings per yard at 1½ lb. per cutting.

Chillies and other garden crops.—Four to eight women are sufficient per acre.

Paddy.—One man or woman will lift seedlings, bundle and clean them for 4 to 5 women depending on the distance of the seed-bed. If seedlings are supplied it will need 12 to 15 women to transplant an acre. If the planting is done singly, when the women become accustomed to it, they will plant more quickly.

A gang will be allotted in the following proportion: 6 ploughs, one levelling board, 6 men or 8 women lifting seedlings, 3 to 6 boys carrying seedlings and 25 women transplanting.

Bundling seedlings in a paddy seed-bed.—A man will pull and bundle about 1 cent per day, i.e., from 200 to 250 bundles. On contract he will do at least twice as much and will be paid at the rate of ¼ to ½ an anna per 20 bundles. 1,000 to 1,500 bundles will be sufficient for transplanting an acre singly.

Onions.—20 to 40 women transplant one acre in a day according to the spacing of the bulbs.

Pepper.—Digging holes and planting 400 standards per acre, 12 men; digging pits and planting pepper cuttings, 12 men per acre.

Plantains.—Digging 900 holes 1 foot deep per acre, 4 men; lifting suckers, 4 men; planting, 8 men; pressing, 18 men.

Groundnuts.—Dibbling, 15 women per acre including weeding, exclusive of weeding, 10 women in cumbu and 12 in ragi.

Ragi.—Generally planted singly. Three women will lift seedlings for 15 women to plant. For planting in ridges 10 to 12 women per acre, and for beds 14 to 16 women per acre are required. One man and two women plant an acre of dry ragi a day.

Turmeric.—Behind plough, one and a half pairs and drivers with 4 or 5 boys will sow an acre in the day.

Ploughing.—First ploughing with the country plough in dry land, half acre for each pair daily. There should be no ridges left between the furrows.

In subsequent ploughings the plough takes a little more land and the area covered is about ¾ acre daily.

In ploughing to cover seed an acre a day may be expected. In wet land (puddling), generally with inferior animals, 25 cents the first time, about 35 cents the second time and half an acre for third and subsequent ploughings. With black-cotton soil iron plough, four men and four pairs will plough 40—60 cents; when the soil is very hard, another man is required.

Gallows plough with two pairs will do 50 cents a day unless the lead is very short. In Ceded districts half acre can be ploughed daily with the cotton soil plough, using four pairs of cattle. In places where this implement is newly introduced, the work turned out is less, only one-third of an acre being ploughed daily.

R.I.S. plough and Turnwrest plough—40 to 50 cents a day.

Ridging.—A man with Ransomes double mould board plough and a pair of cattle can ridge up to 1½ acres a day (ridges 1½ feet apart) in land already well ploughed.

Rope-making.—One man and one woman or boy will twist 30 to 38 lb. of fibre into rope in a day.

Twists of straw for packing grains are made 30 feet long, and 2 men can make 40 twists in a day.

Sowing broadcast.—A man will sow 1 acre an hour. To cover this one man and a pair of bullocks will take one full day.

Sowing modan (dry land) paddy in Malabar.—Eight men will carry to the field sow and rake in the seed for an acre (about 60 lb.).

Groundnuts.—Three pairs of cattle and 6 women extra will do an acre in half day, that is 2 women or men behind each plough, if sowing is done in every furrow.

Spreading—*Manure.*—The heaps are generally one cart-load (10 cwt.); with light dressings (15 to 20 cartloads) 6 women per acre will spread; as the heaps get closer there is less lead but more stuff to carry, so for heavy dressings 8 women will be needed per acre.

One man will spread 8 cartloads per day. Applying castor cake to sugarcane, 1 man will apply one bag and for every 4 men, 1 woman or boy will be required to carry.

Thatching.—One man will thatch 400 square feet per day with a woman to help.

Threshing.—*Cholam.*—The heads are spread out on the floor and are either beaten by sticks or are pressed under the stone roller. One man will beat the produce of an acre

(1,000 lb. of heads or 600 lb. of grain) in one day. With roller two pairs of animals with drivers, and 2 men and 4 women will thresh out 6,000 to 7,000 lb. of grain in a day.

Threshing by bullocks.—A team consists of four animals with driver, 2 men to turn heads and 2 women. They will thresh 1,300 lb. of grain per day.

For threshing with machine, 2 men to feed the machine, 1 woman to supply heads, 5 women to collect and remove the empty heads after the second threshing, and 1 woman to collect the grain into a heap 15,000 lb. per day of eight hours.

Paddy.—This is usually threshed in two operations. The heads are first beaten against a board and 90 per cent of the grain removed. One man with a woman or boy to hand him the bundles can thus beat out 2,000 lb. a day. The straw is afterwards trodden out by cattle. In this second threshing roughly, 16 bullocks with 4 boys to drive will thresh out 2,000 lb. per day while six will stack the straw in the same time.

If the paddy is trodden out directly by cattle, a team of 16 cattle, i.e., four yokes of four each with 4 men or boys to drive, and 3 men to turn the straw, will thresh out 7,000 lb. of grain per day.

Bengal gram.—With the stone roller, a team of two pairs 2 drivers and 3 women will thresh 4,000 lb. per day. If the stuff is trodden with cattle 16 bullocks and 7 men or boys will thresh 5,000 lb. per day. If threshed with sticks 1 woman can thresh out 80 lb. grain per day.

Ragi.—Two pairs of cattle, 5 men and 2 women can thresh about 2,000 lb. per day.

Cumbu.—Two pairs of cattle, 2 men and 2 women thresh 1,500 lb. per day.

Trenching.—For cane, 25 men per acre.

Watching paddy.—One *palikapu* to watch and irrigate 50 acres if in one block.

Weeding *by hand.*—Three to five women will weed an acre of land. The figure varies very much with the state of the land.

Winnowing 18-*inch machine.*—One woman turning, two supplying and one collecting will clean 3,000 lb. of cholam, 1,000 lb. of paddy, 1,500 lb. of ragi or tenai and 2,250 lb. of cumbu in a day. (Half the quantity noted above of cholam, if machine threshed, on account of the presence of glumes.)

Wrapping-- *Canes.*—First time 15 men per acre to wrap and 5 boys to remove rubbish and weeds.

Second time 20 men to wrap and 10 boys to remove rubbish.

Third and subsequent 25 to 30 men to wrap and 1 or 2 boys to remove rubbish.

Fixing bamboos.—(3,000 to 3,500 per acre.) One man will fix about 300 bamboos per day.

* Cost of Labour by Piecework or Contract or Share System.

Cotton ginning.—Three annas per maund of 26 lb. of kappas. Eight pies an edai in Tinnevelly. Ten to twelve annas by machine for 250 lb. of kappas, Rs. 5 per candy (500 lb.) of lint.

In Tinnevelly Re. 1 for 247 lb. of kappas.

Cotton picking.—Usually on the share system, one-tenth to one-sixteenth according to the ease of picking and the yield of the season crop. Out of season, it may go down to one-third.

Cotton stalks, removing.—This can be done at Rs. 1–4–0 per acre. It is much cheaper with the puller. (See page 37.)

Crowbarring—In Coimbatore Rs. 10—15 per acre in wet lands. Rs. 7—10 per acre in wet lands in Gōdāvari.

Dry lands Rs. 6 to 8 per acre in the Gōdāvari.

South Arcot Rs. 12 to 15 per acre.

Cumbu harvest.—One-sixteenth to one twenty-fourth of the produce (Tinnevelly).

Digging Hariali.—Coimbatore, Rs. 32 in black soils and Rs. 37 in red soils per acre. The contractor is bound to clear anything left in the next year, pending which one tenth of the sum is withheld. Rs. 5 extra per acre, if the work is in patches. Sixty sq. yards per rupee in the Deccan.

Digging cane stubbles in wet lands Rs. 7½ per acre. In Gōdāvari Rs. 5 per acre.

Digging with mamuty.—Ceded districts, Rs. 2–5–0 per acre in wet lands. Coimbatore, Rs. 4½ in wet lands. Kuli-vettu or levelling wet lands : 1 Kuli = 4 Koles, i.e., 48 ft. × 3 ft. × 9 in. the rate for this is 2½—3 as.

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* These are all at pre-war rates and will in most cases have to be considerably increased.

Digging wells.—One niluvu or man's height and 4 feet diameter :—

	RS.	A.	P.
First niluvu	0	12	0
Second ,, ...	1	4	0
Third ,, ...	1	8	0
Fourth ,, ...	3	0	0

Fibre extraction.—In Gōdāvari, one-eighth of the fibre in a good crop of sunnhemp to one-fourth in a bad crop is given for cutting, retting, stripping and washing.

Groundnut lifting.—Contract Rs. 10 per acre, for a rainfed crop or else for one-fourth to one-eighth the crop ; or piece-work 2—4 pies for every marakkal (2 Madras measures), the higher rate being for the rainfed crop.

Stripping nuts off haulms : 2 p. a Madras measure : picking nuts out of ground after they have been dug : 9 p. a Madras measure (Pollachi).

Penning-cattle.—In Ganjām Re. 1 for a herd of 100 to 150 cattle for one night : in Tanjore, 4 to 6 marakkals of paddy per 100 or, 1 rupee and 2 Madras measure rice.

Hurdles.—Ordinary tattis of split bamboo, 2 annas per square yard inclusive of the cost of the material. Trellis work 3—3½ annas per square yard.

Paddy.—Reaping, threshing and cleaning are done in Gōdāvari at one-tenth of the crop. Reaping : carrying and first threshing : one twenty-fourth of the crop (Pollachi).

Planting is done on contract in Tinnevelly in some parts at 42 Madras measures of paddy per acre. Paddy seedlings in Tanjore are pulled by men at 1½ to 2 pies a big bundle. Reaping, binding and taking to threshing floor in Coimbatore at three selagais of paddy for 3·20 acres crop.

In Tanjore 72 Madras measures per acre for harvesting, threshing and stacking per acre ; or one Madras measure for every kalam (24 Madras measures) of paddy threshed and leaned. Stacking extra labour : 1 man to 20 women harvesting; thus.

	Madras measures.
For 30 kalams cleaned and stored	30
Two Madras measures extra for 8 men ...	16
Wages of 1 man stacking	2
	48

In Malabar one-seventeenth of the crop for harvesting only.

Husking.—$2\frac{1}{2}$ M.M. of paddy or $1\frac{1}{4}$ M.M. of rice for every 96 M.M.

Picking chillies.—One twenty-fourth of the quantity picked.

Picking coconuts.—One nut for every five trees picked o 3 pies for every tree.

Coimbatore rate : 7 coconuts peeled for every 100 coconuts picked from trees and peeled free of outer coat and given ready for sale.

In Gōdāvari two nuts for every hundred picked and from 4 annas to 10 annas per 1,000 for removing the outer covering.

Ploughing—with cotton soil plough Rs. 5 to Rs. 8 per acre.

Prickly-pear : clearing.—This varies widely with denseness of the pear and the thoroughness of the eradication. Probably, in very few cases, should Rs. 50 an acre be exceeded for complete removal. This will of course spring up again, unless the land can be subsequently ploughed.

Rope-making.—Twelve annas for making a mhote rope o 25 lb. of fibre and 4 annas for a tail rope.

Sawing timber—varies with the hardness and dryness of the wood. In Coimbatore a unit is 12 square feet and for sawing a surface of this dimension the charge is 6 annas.

Sheep penning.—Three-hundred sheep per day per rupee ; at 3,000 sheep per acre, this comes to Rs. 10 per acre.

In Tinnevelly 2,000 sheep for Rs. 7 ; 350 cattle for Rs. 5 to Rs. 7. Tanjore : 1 thundu of 100 sheep for 3 marrakkals paddy.

Straw twists.—One hundred twists of 30 feet length for Rs. 1-4-0. In Tinnevelly 12 annas for 100 twists of 30 feet length.

Sweet potatos.—On sandy soils one-tenth to one-eighth is paid in kind for lifting ; contract price on heavy soils Rs. 10 to Rs. 12 per acre.

Threshing cholam.—One-eleventh to one-twelfth the produce in grain for threshing by hand (Guntūr).

Turmeric.—Annas 2 per cent dug : $\frac{1}{2}$ anna per maund for cleaning

SOILS.

Soil is the uppermost layer of the earth's surface, and consists of the more weathered portions of the rocks of which the earth is composed. It is immediately underlain by the subsoil. It consists of stones, gravel, sand, silt, clay and organic matter in varying proportions.

Classification of Soils.

	Per cent clay.
Sandy	Under 10
Sandy loam	10–20
Loam	20–30
Clay loam	30–50
Clay	over 50

Besides this we may have calcareous soils, containing over 20 per cent calcium carbonate, humous soils with more than 5 per cent organic matter, and gravelly soils containing varying quantities of gravel or kunkur.

Residual or sedentary soils are those formed *in situ* from the disintegration and decomposition of rocks.

Transported soils are formed from disintegrated and partly decomposed rock, but instead of remaining in the place previously occupied by the rock, they have been transported and retransported by various agencies such as wind and water to the place where they are now found.

Rock-forming Minerals.

Felspar, an anhydrous double aluminium silicate with potash, soda or lime. Orthoclase is a potash felspar and is the commonest. Felspars on decomposition give rise to clay which is a hydrated aluminium silicate, or laterite.

Quartz.—Silica or an oxide of silicon. It is found in all crystalline rocks and forms the bulk of ordinary sand where it is often coloured red with oxides of iron.

Mica is found in many volcanic rocks and is a constant constituent in the gneissic rocks of Southern India. It is extensively quarried in Nellore.

Carbonate of lime commonly found as accretionary deposits of kunkur or nodular limestone.

Chemical Analyses.

An exact chemical analysis of a soil may be useful as showing any deficiency in plant food, but it is not generally of great practical use, because it does not show in what state the elements exist—whether suitable for plant food or not. Analyses may, however, show the *available* amounts of the plant foods present by the use of a 1 per cent solution of citric acid (Dyer's method). This is purely emperical, but has been found to give good results. Mechanical analyses show the sizes of the particles composing the soil which are usually given in six grades. Analyses of three classes of soils at the Coimbatore Central Farm are given below. They represent "dry red," "garden" and "black" soils, respectively.

Constituents.	Garden land, Number 20.	Dry red land, Number 10.	Black soil, Number 13.
Sand and insoluble ...	79·040	86·780	78·50
Fe_2O	4·730	2·250	3·06
Al_2O	6·680	4·190	7·06
CaO	1·500	1·520	3·67
MgO	·920	·490	1·49
K_2O	·530	·210	·39
Na_2O	·120	·180	·18
CO_2	·540	·660	1·30
P_2O_5	·115	·028	·05
SO_3	·030	·011	Trace.
Loss on ignition	5·795	3·681	4·24
Total ...	100·000	100·000	100·00
Nitrogen	·0567	0·037	·034
K_2O available	·018	·008	·003
P_2O_5 available	·036	·011	·015

MECHANICAL ANALYSES.

Constituents.	Number 20.	Number 10.	Number 13.
Fine gravel	6·3	18·3	9·5
Coarse sand	17·4	41·1	25·0
Fine sand	19·1	15·1	15·1
Silt	6·5	2·1	6·4
Fine silt	21·1	9·8	28·1
Clay	25·7	12·4	12·0
Moisture, etc.	3·9	1·2	2·8

MANURES.

FARM YARD MANURE.

Farm yard or cattle manure, consisting of the excreta of animals mixed with litter and refuse forms one of the most efficient and generally available means of restoring fertility in the soil. Its value consists not only in the actual plant food it contains but also in the carbonaceous matter which serves to improve the physical condition of the soil, rendering clayey soils more porous and loose soils more retentive of water. Its compostion is from its nature variable and depends on how it is prepared and conserved. There are three main systems in use in the Presidency: (1) The heap system which is wasteful, (2) the pit system in which the dung is stored in a pit to which the urine is led and litter earth is added from time to time; the pit is usually sheltered from sun and rain, (3) the loose box system in which the manure is formed and compacted under the feet of the animals. This system results in the minimum of loss and systematic experiments have shown that it is the best.

The following analytical figures in respect of each of the three different methods of making farm yard manure are based on experiments conducted at the experiment stations in different parts of the presidency:—

Composition of farm yard manure obtained by different methods.

Method of making.	Moisture per cent.	Per cent in dry manure.		
		N.	P_2O_5.	K_2O.
Heap	31·3	1·02	·63	1·76
Byre pit ...	51·1	1·49	·92	2·40
Loose box ...	47·0	1·36	·67	3 03

The following table gives average values for the total dry weight of manure obtained under each system during twelve months from one pair of working cattle together with the amounts, of N. P_2O_5 and K_2O contained in these :—

Method of making.	Dry manure.	N.	P_2O_5.	K_2O.
	LB.	LB.	LB.	LB.
Heap	3,817	38·01	24·09	66·73
Byre pit ...	3,303	43·69	28·24	79·83
Loose box ...	6,194	75·93	40·75	171·60

Nitrogenous Manures.

Nitrogen is the most important constituent in the cakes which form so important a manure for many crops. This substance can also be purchased alone in various forms. The following shows the percentages of nitrogen, they should contain :—

Nitrate of Soda—15–16 per cent.

Nitrate of Potash—13 per cent.

Nitrate of Lime—13 per cent.

Sulphate of Ammonia—20–21 per cent.

Calcium Cyanamide (Lime Nitrogen: Nitrolim)—20 per cent.

Phosphatic Manures.

Phosphorus is usually supplied as ashes, or in the form of cake or fish manure, but it can be purchased in a more concentrated form as bone meal, bone superphosphate, steamed bones, rock superphosphate or basic slag (Thomas phosphate).

Average analyses of these manures are given below :—

—	Water.	Organic matter.	Nitrogen.	Phosphoric acid.	Lime.
Bone meal	6·0	30·3	3·8	23·2	31·3
Bone superphosphate ...	13·0	24·0	2·5	16·7	...
Steamed bones	5·2	17·5	1·6	30·9	41·8
Rock superphosphate ...	14·0	7·0	·6	16·1	...
Basic slag	3·4	...	...	19·0	45·0
Trichinopoly phosphate.	·99	3·90	...	23·83	54·16

The phosphoric acid in superphosphate is in a soluble form and is therefore considered more valuable. For wet lands, however, it is doubtful whether this is necessary, and bone meal or fish manure are probably better. Steamed bones are rich in phosphoric acid, but have lost a proportion of their organic matter. Thomas phosphate contains a large proportion of lime and is valuable in acid soils, but is heavy and expensive to transport. It should be ground to a very fine powder. "Trichinopoly phosphate may also be used on paddy lands along with green leaves or oil cake, but it is not so useful as bone meal."

POTASH.

Potash may be supplied as potassium sulphate, potassium chloride (Muriate of potash), or Kainit. It is not generally considered an important manure for South Indian soils though if analysis shows less than 25 per cent of total potash in a soil, experiments should be tried with potash manures. Kainit is a mixture of potash and magnesium salts and contains often fairly large quantities of common salt. Its use is practically unknown, most experiments with potash having been carried out with the sulphate.

Common Manures.

Analyses of cakes.

—	P_2O_5.	K_2O.	N.
White castor	2·61	1·24	6·42
Black castor	1·86	·70	4·50
Pungam	1·34	·66	3·58
Neem (Margosa)	1·31	1·69	5·04
Groundnut	1·40	1·21	8·04
Safflower	1·48	·82	5·83
Punnai*	1·08	1·55	2·65

Castor cake.—This is universally esteemed for the cultivation of the sugarcane crop to which it may be applied at a rate of 1,000 to 2,000 lb. per acre. A common application in Gōdāvari is 10 bags of 164 lb. each, given in two applications. Its cost is about Rs. 80 per ton. As will be seen from the analysis it is a general manure. It is known as black or white cake according to the proportion of husk left in.

Groundnut cake is not considered so good as castor cake for canes, but is largely used for paddy in certain districts. It is generally better to use it as food for cattle and return its constituents to the soil in the shape of dung.

Margosa cake made from the seed of the neem tree, which is collected by women and children from under the trees. The oil is used medicinally. The use of this cake could probably be extended.

Pungam cake used in many places where it can be bought as cheap as Rs. 35 a ton.

Fish mauure (ordinary).

Water	6·5 to 15·0
Organic	36·5 to 60·0
Ash	18·4 to 41·0
	...
N	4·4 to 6·8
P_2O_5 ...	3·9 to 5·3
K_2O	·2 to ·7

Fish-guano.

Water	8·26
Organic	66·88
Ash	24·86
	100·0
N	8·40
P_2O_5	8·63
K_2O	0·50

* Calophyllum Inophyllum.

Fish manure.—This is a most valuable manure which is not yet appreciated at its proper worth. It is a general manure, especially rich in phosphoric acid. It can be produced in large quantities on the West Coast. The fish are simply spread on the beach to dry and are subsequently pounded. This generally causes a considerable amount of adulteration with sand which it is impossible to remove completely: good samples, however, should not contain more than 20 per cent by weight. There is also a considerable proportion of oil which partially prevents decomposition. Fish from which the offal has been removed and the oil extracted, are ground up and sold as fish-guano which is a dry powder, capable of storage without decomposition and a more concentrated manure than ordinary Milled Fish. There are also other bye-products obtainable which however should not be purchased without analysis.

Tannery refuse.—This may consist of spent bark and of the refuse obtained from the process of tanning. It is reported to be valuable in alkaline lands. Wool, Hair, Hooves, etc., are all waste products which are used as manures. They are mostly nitrogenous, but their use for dry lands is not recommended as they are very slow in decomposition. Round Madras they are largely used for the paddy crop.

Waste from rice mill.		Indigo waste (seeth).	
—	Parts per 100,000 of liquid.	—	Parts per 100,000 of liquid.
Total N	16 to 56	Water ...	12·90
Ammoniacal N ...	8 to 9	Organic ..	81·12
Albuminoid N ...	2 to 33	Ash ...	5·98
		Total .	100·00
P_2O_5	40 to 51	N ...	1·84
K_2O	98 to 129	P_2O_5 ...	·361
		K_2O ...	·277

Mill refuse.—The waste liquor from sugar or spirit factories is, though very dilute, highly esteemed for irrigation and its effects can be seen on the lands near the Nellikuppam and Samalkota factories. Ashes too are largely

available from most factories. The blowings from rice mills, a very fine dust consisting of particles of bran, husk, etc., may be used with good effect, while the effluent from rice mills could be used for irrigation.

Village earth (*Pati mannu*).

H_2O	4·20
Organic	4·22
Sand	75·51
Fe_2O_3 and Al_2O_3	9·82
CaO	2·60
MgO	·78
K_2O	1·39
Na_2O	·32
P_2O_5	·69
CO_2	·32
Total ...	99·85
N	·094

Village earth.—This may be scraped or brushed from old walls, or dug from pits in old village sites and consists of a greyish powdery earth containing nitrogen, potash and phosphoric acid. It varies largely in composition and is used for paddy and cane, to the former of which crops it has been very largely applied in the Kistna.

Ashes.

	P_2O_5	K_2O
Cane trash	·78	2·51
Cotton stalk ash	1·77	9·35

Village refuse.—This again is a manure which varies very largely in quality. It consists of house sweepings, dung, ashes, and refuse fodder and is the most commonly used manure in South India. If cattle dung largely predominates it is called cattle manure, but is nearly always obtained in a dry and powdery condition.

Green manures (when fresh).

Name of plant.	Dry substance.	Nitrogen per cent. Air dry about 10 per cent moisture.	Fresh plant.
Sunnhemp ...	1·67	1·50	·71
Dhaincha ...	3·30	2·97	·62
Kolinji	3·55	3·20	1·06
Indigo	2·19	1·97	·66

The value of these leguminous crops lies partly in the addition they make to the nitrogen in the soil and partly in the extent to which they ameliorate the physical condition of the soil, when ploughed under. The three commonest are Sunnhemp, Wild Indigo (*Tephrosia purpurea*) and Dhaincha (*Sesbania aculeata*). The rate at which these are sown, unmixed and for green manure, is respectively 30 lb., 15 lb. and 15 lb.

Green leaf.—"Green manures whether cut from forests or grown in situ and applied to fields improve the physical texture of the soil. Growing green manure crops on the land is cheaper. Sunnhemp, kolinji and indigo are suitable for loamy soils although kolinji can be established in heavy soils by persistent sowing. Dhaincha is suitable for clayey soils and has been found to improve saline soils."

Nightsoil.—The use of this valuable product is being extended in the neighbourhood of the larger towns, especially by those engaged in the cultivation of garden crops. The general method of treating this substance is to bury it in shallow trenches, and allow it to be absorbed by the soil and gradually undergo decomposition. In a few months it will become a dry powder in handling which little difficulty will be experienced.

Lime as a manure.—This substance is a plant food and when lacking, must be supplied to obtain good crops. The

quantity needed is however so small that very few soils are without it. Liming consequently is not known. Experiments in its use are in progress at some of the Agricultural stations but little effect has as yet been noted. It has a beneficial effect in soils heavily charged with organic material, and assists in obtaining a tilth on stiff clayey soils while it is said to exert a binding influence on sandy soils. It may be applied as burnt or slaked lime.

MANURIAL INGREDIENTS REMOVED FROM THE SOIL BY THE PRINCIPAL CROPS (POUNDS PER ACRE).

Name of crop.	N.	P_2O_5.	K_2O.	CaO.	Remarks.
Paddy ...	48	23	41	...	
Cholam ..	72	25	45	...	
Ragi	49	30	202	...	
Cotton ...	97	29	83	179	12,000 plants per acre.
Sugarcane ...	56	68	190	55	40 tons including leaves, etc., 25 tons canes topped.
Tobacco ...	67	9	85	69	1,000 lb. of tobacco per acre.
Coconut (nuts only).	1·5	·2	1·0	...	50 trees per acre and 100 nuts per tree.
Plantain ...	·25	·1	1·0	...	800 trees per acre.
Tea	20	3	10	2·3	400 lb. made tea and assuming prunings are returned to the soil.
Coffee ...	42	7·4	47	...	7 cwt. of parchment and assuming prunings are returned to the soil.

UNIT PRICES OF MANURES AVAILABLE IN INDIA.

	RS.
N in ammonium sulphate	12·3
N in nitrate of soda	15·0
N in refined saltpetre	6·7
N in crude saltpetre	6·7
N in calcium cyanamide	10·0
N in calcium nitrate	* 13·0
N in bone meal, N in poonacs	12·0
N in fish manure, N in dried blood	10·0
P_2O_5 in superphosphate	4·8
P_2O_5 in bone meal	·9
P_2O_5 in fish	·9
K_2O in sulphate of potash	3·7

Summary.

Potash	3·5
P_2O_5 soluble	5·0
P_2O_5 insoluble	1·0
N in saltpetre imported	13·0
N in saltpetre	6·5
N in bones, poonacs, etc.	11·0

These can only be taken as approximate.

"UNIT" PRICES OF MANURES.

The price divided by the percentage gives the cost of a "unit," i.e., the one-hundredth of a ton. If a standard unit

* The lime has not been valued.

price is adopted, the *real* value of any manure can be found by multiplying the percentage of each ingredient by the standard price and adding all together. The real value can then be compared with the market price.

It is customary in fixing the prices of manures per ton, on the system of valuing by units, to allow only for the phosphates dissolved or soluble, the phosphates undissolved or insoluble, the nitrogen equal to ammonia and the potash. Other items are seldom taken notice of, and in the case of a mineral superphosphate it is not even usual to allow for the insoluble phosphate.

The above prices are of course only approximate, as they vary according to markets, and only represent the value at the ports or manufactories; the cost of bags, carriage, credit, etc., must be added according to circumstances.

It must be borne in mind that the commercial values bear no relation to the manurial values; the soluble phosphate in a mineral superphosphate, for instance, being probably as good for the plants as that in a bone superphosphate, although the latter has a higher market value. The cheapest sources should be tried first in experiments.

Relative Manurial Value of Different Manures.

Average of several authorities.

Nitrogen in ammonium sulphate, guano, etc.	100
Do. sodium nitrate	98
Do. fish-guano, meat meal, etc.	81
Do. bonemeal, horn meal, etc.	77
Do. farm yard manure	56
Phosphoric acid in superphosphate	100
Do. guano	92
Do. bone meal	88
Do. medium meal	64
Do. coarse meal	40
Do. basic slag	33
Do. farm yard manure	33
Potash in sulphate	100
Do. chloride (muriate)	82

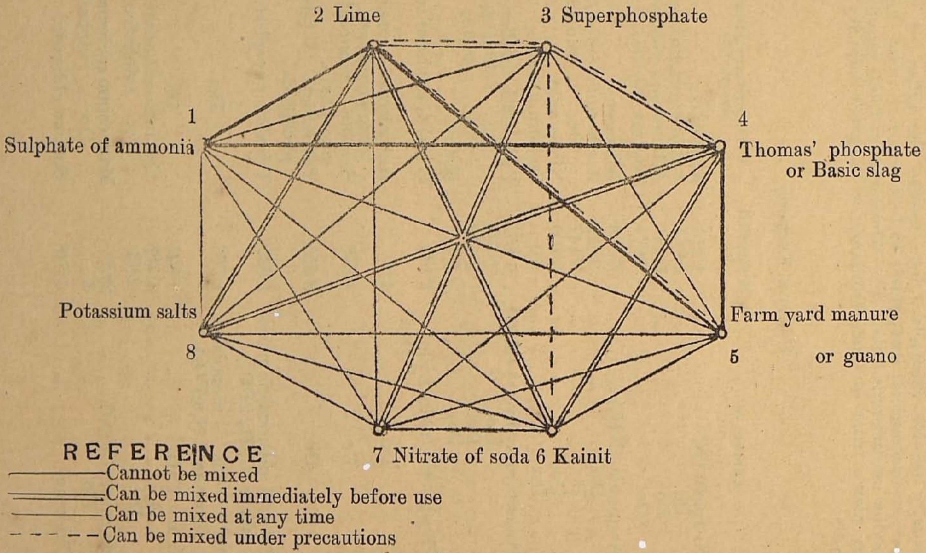
Nitrogen, phosphoric acid, and potash are the only three substances which require to be applied in ordinary manuring and most manures are valuable only in proportion to the amounts of these they contain; while manurial experiments

usually resolve themselves into testing the effect of the various commercial compounds and mixtures of these three bodies on different soils. The other mineral foods required by plants exist in superabundance in the great majority of soils.

USEFUL FACTORS.

Amount of	Multiplied by	Gives corresponding amount of
Nitrogen (N)	1·214	Ammonia.
Do.	4·714	Ammonium sulphate.
Do.	6·25	Albuminoid matter.
Do.	6·071	Sodium nitrate.
Ammonia (NH_3)	0·824	Nitrogen.
Do.	3·822	Ammonium sulphate.
Do.	3·147	Do. chloride.
Do.	3·706	Nitric acid.
Do.	5·0	Sodium nitrate.
Potash (anhydrous) (K_2O).	1·85	Potassium sulphate.
Do.	1·585	Do. chloride.
Do.	2·149	Do. nitrate.
Do.	7·4	Kainit.
Phosphoric (anhydride) (P_2O_5).	2·183	Tricalcium phosphate.
Do.	1·4	Anhydrous monobasic phosphate.
Do.	1·648	Soluble monocalcic phosphate.
Do.	2·555	Tetracalcic (slag) phosphate.
Soluble monocalcic phosphate ($CaH_4\,2PO_4$).	1·325	Tricalcic phosphate.
Anhydrous monobasic phosphate (Ca_2PO_3).	1·566	Do.
Lime (CaO)	1·845	Do.
Do.	1·786	Calcium carbonate.
Do.	2·43	Do. sulphate.
Magnesia (MgO)	2·09	Magnesinm carbonate.
Do.	3	Do. sulphate.
Chlorine	1·648	Sodium chloride.

DIAGRAM OF MANURES NOT TO BE MIXED.



CROPS.

CEREALS.

PADDY.

(*Oryza Sativa*).

Tamil	Nellu.
Telugu	Vadlu.
Malayalam	Nellu.
Kanarese	Batta.
Hindustani	Dhan.
Oriya	Dhanno.
Tulu	Bar.

Area in Madras—11,419,800 acres.

The number of varieties is very large, even if allowances are made for the same variety receiving different names in different localities. These varieties differ in the colour either of the seed-coat or glume; their duration of growth, from three and a half to nine months; and their quality, i.e., the delicacy and flavour of their rice. The crop is normally grown in wet lands irrigated from canals or tanks (rain or river fed); it is occasionally seen as a garden crop (e.g., Salem, North Arcot, etc.), growing in similar conditions. It may be either broadcasted or transplanted. As a dry crop it is extensively found in the Northern Circars and on the West Coast. It is occasionally sown dry and subsequently irrigated.

Seed-rate—Broadcast, 50 to 75 lb. per acre. Transplanted, 20 lb. from 7 cents of land will plant up one acre. But this seed-rate is usually very largely exceeded, up to 150 lb. per acre being used.

Volume weight—1 M.M. weighs 2·5 lb.

Husk to grain—33 to 36 per cent by weight.

Weight of seed—1,000 grains weight 16 to 25 grammes.

Number of seeds in 1 lb.—18,000 to 27,000.

Germination capacity—90 to 100 per cent.

Yield—Good delta land—2,000 to 4,000 lb. of grain, 3,000 lb. of straw. Average tank irrigated land—1,500 to 3,000 lb. of grain, 2,500 lb. of straw.

CHOLAM.

(*Sorghum vulgare.*)

Tamil	Cholam.
Telugu	Jonnalu.
Kanarese	Jola.
Malayalam	Cholam.
Hindustani	Juari.
Oriya	Jonna.
Tulu	Ari Jola.

Area in Madras—5,230,560 acres.

Varieties—Numerous : see Bulletin No. 55, Department of Agriculture, Madras. It is grown as a dry or irrigated crop on almost any class of soil. It is also grown thickly as a fodder crop when it is not intended to produce grain.

Seed-rate—10 to 15 lb. Irrigated 20 to 35 lb.; for fodder up to 100 lb.

Volume weight—1 M.M. weighs 3·1 lb.

Husk to grain—14 per cent by weight.

Weight of seed—1,000 seeds weigh 25 to 30 grammes.

Number of seeds in 1 lb.—15,900.

Germination capacity—95 per cent.

Yield—Average produce of garden lands—2,000 to 3,000 lb. of Grain, 5,000 to 7,000 lb. of straw.

Dry lands : grain 1,000 lb. per acre in best black soils. 700 in good red soils ; down to 300 lb. in dry Tracts of Ceded Districts.

FODDER CHOLAM.

When grown for fodder it is often mixed with pulses and may be rainfed or irrigated on dry or garden land. Many varieties are used for fodder. Peria manjal cholam has proved exceptionally good in the sixth (Madura) Circle. Responds to manure. Cattle manure 15·20 cartloads per acre after preparatory cultivation with a monsoon plough.

Seed-rate. 50 lb.

Field. Cut when flowering has ceased about 3½ months after sowing. 15,000 to 20,000 lb. With irrigation and heavy manuring 38,000 lb.

BULRUSH OR SPIKED MILLET.

(*Pennisetum Typhoideum.*)

Tamil	Kambu.
Telugu	Sajjalu or Gantelu.
Kanarese	Sajje.
Malayalam	Kampam.
Oriya	Gantiya.
Hindustani	Bajra.

Area in Madras—3,124,340 acres.

There are long and short duration varieties : varieties are also known in which the grain thrashes free of the husk (*Arisikumbu*). The crop is grown either under dry or garden conditions. The former is sown during the monsoon seasons, and the latter during the hot weather : as a dry crop it generally occupies poor soils, save in Tinnevelly and Rāmnād, where it takes the place of cholam on black soils. It has wonderful tillering capacity. It is quick growing, and therefore may be raised as a fodder crop though the straw is considered when ripe, inferior in quality to cholam.

Seed-rate—3 lb. in black soils; others 6 to 10 lb.

Volume weight—1 M.M. weighs 2·7 lb.

Husk to grain—7 to 8 per cent by weight.

Weight of seed—1,000 seeds weigh 4 grammes.

Number of seeds in 1 lb.—111,400.

Germination capacity—93 per cent.

Yield—Up to 1,000 lb. of grain on best black soils. In other soils about 300 lb. is an average crop. Productivity inferior to cholam both in fodder and grain.

RAGI.

(*Eleusine Coracana.*)

Tamil	Kelvaragu or Ragi.
Telugu	Ragulu, Thamidalu Chodulu.
Malayalam	Muttari.
Kanarese	Ragi.
Hindustani	Ragi.
Oriya	Mandiya.
Tulu	Ragi.

Area in Madras—2,544,900 acres.

Varieties—There are distinct varieties for dry and garden lands and for early and late seasons. Plants differ also in the nature of panicles (open or closed). In a few parts of Madras, this is grown as a dry crop (generally mixed with pulses and castor) in the uplands of Salem, Coimbatore and Hindupur, in Vizagapatam, and in valleys near the hills. In some districts it is raised as the first crop on wet lands with limited or precarious water-supply. Elsewhere it is a garden crop, being raised in seed-beds and transplanted in beds or in ridges.

Seed-rate—2 lb. in 2 cents of land for planting out 1 acre. In dry lands about 3 lb. is mixed with pulses.

Volume weight—1 M.M. weighs 3·07 lb.

Husk to grain—5 to 6 per cent by weight.

Weight of seed—1,000 seeds weigh 2·88 grammes.

Number of seeds in 1 lb.—157,500.

Germination capacity—95 to 99 per cent.

Yield—2,000 to 3,000 lb. garden crop. The straw is usually cut and fed partly green, and will weigh up to 8,000 lb. Dry crop, 1,000 to 1,500 lb. of grain and 4,000 lb. of straw.

ITALIAN MILLET.

(*Setaria Italica.*)

Tamil	Tenai.
Telugu	Korralu.
Kanarese	Navane.
Malayalam	Tena.
Hindustani	Kanguni.
Oriya	Kangu.

Area in Madras—1,453,340 acres.

There are several cultivated varieties differing in the colour of the seed which may be any shade of yellow to orange, brown or black. Grown as a dry or an irrigated crop on almost any soil. Frequently mixed with cotton as a dry crop; but is not generally mixed with pulses as other cereals.

Seed-rate—5–6 lb. per acre as a garden crop: half that for dry lands, with further reduction if sown as a mixture.

Volume weight—1 M.M. weighs 3·57 lb.

Husk to grain—20 per cent by weight.

Weight of seed—1,000 seeds weigh 2·70 grammes.

Number of seeds in 1 lb.—168,000.

Germination capacity—95 per cent.

Yield—Dry crop up to 600 lb. Irrigated up to 1,000 lb.; 1,000 to 2,000 lb. of straw per acre.

SAMAI.

(*Panicum Miliare.*)

Tamil	Shamai.
Telugu	Samulu.
Malayalam	Shama.
Kanarese	Shame.
Hindustani	Savan.
Oriya	Suniva.

Area in Madras—764,080 acres.

There are long and short duration varieties of Samai: One with black glumes is also known. It is usually grown as an early dry crop, occupying poor soils and is mixed with pulses.

Seed rate—10 lb. per acre.

Volume weight—1 M.M. weighs 3·1 lb.

Husk to grain—44 per cent by weight.

Weight of seed—1,000 seeds weigh 2·65 grammes.

Number of seeds in 1 lb.—171,200.

Germination capacity—98 per cent.

Yield—400 to 600 lb. of grain; 800 to 900 lb. of straw per acre.

COMMON MILLET.

(*Panicum Miliaceum.*)

Tamil	Panivaragu or Kadaikanni.
Telugu	Varigalu or Barigalu.
Kanarese	Baragu.
Hindustani	...
Oriya	Rala.

There are two varieties grown which differ in colour of the glume. The crop is grown dry on poor soils: and only occasionally as a garden crop.

Seed-rate—10 lb. per acre.

Volume weight—1 M.M. weighs 3·09 lb.

Husk to grain—35 per cent by weight.

Weight of seed—1,000 seeds weigh 5·12 grammes.

Number of seeds in 1 lb.—88,600.

Germination capacity—99 per cent.

Yield—500 to 600 lb. of grain ; 900 lb. of straw. An irrigated crop will yield up to 1,200 lb. of grain per acre.

SANWA MILLET.

(*Panicum Crusgalli* var *Frumentaceum.*)

Tamil ... ... Kudiraivali.
Telugu .. .. Oodalu.

A green and a red variety are found growing in Ganjām : elsewhere there seems to be a single variety. It is a minor grain grown usually on poor soils. It grows very rapidly, can stand water-logging and is therefore raised in low lands to prevent wash. The straw is considered good : grain contains a very high proportion of husk.

Seed-rate—35 lb. per acre.

Volume weight—1 M.M. weighs 2·33 lb.

Husk to grain—35 per cent by weight.

Weight of seed—1,000 seeds weigh 3·14 grammes.

Number of seeds in 1 lb.—144,450.

Yield—400 to 500 lb. of grain and 2,000 lb. of straw per acre.

KODO MILLET.

(*Paspalum Scrobiculatum.*)

Tamil ... ... Varugu.
Telugu ... ... Arikelu.
Kanarese ... ... Arikel.
Oriya ... ... Khoddi.

Area in Madras—1,123,820 acres.

Commonly grown dry on poor soils often mixed with red gram (sown in lines 4 feet to 5 feet apart) and seldom manured. Occasionally heavy yields are obtained from alluvial or deep black soils. A very hardy cereal which can be grown on any soil. The grain can be kept good for many years and hence it is a useful famine reserve, though the food and fodder are both inferior. The straw is used as manure for salt lands.

Seed-rate—12 to 20 lb.

Volume weight—1 M.M. weighs 2·76 lb.

Husk to grain—40 per cent by weight.

Weight of seeds—1,000 seeds weigh 5·90 grammes.

Number of seeds in 1 lb.—76,900.

Yield—600 to 900 lb. of grain and 1,000 to 2,000 lb. of straw.

WHEAT.

(*Triticum* Sp.)

Tamil	Godumai.
Telugu	Godumalu.
Malayalam	Kotampam.
Kanarese	Godi.
Tulu	Godi.

Area in Madras—18,500 acres.

Wheat is not an important crop. According to Howard the Madras wheats fall under three heads, viz. *Triticum vulgare*, *T. Durum* and *T. Dicoccum* (*Emmer*). Some of the dry wheats of the northern parts of the Deccan and Akkigodi of Nilgiris fall under the first two varieties, whereas the irrigated wheat of Coimbatore is *Dicoccum*. This last does not thresh out clean, i.e., the "seed" is really the spikelet containing two (sometimes three) grains.

Seed-rate—25 lb. (in 1 and 2); 60 to 70 lb. in *Dicoccum*.

Weight of seed—1,000 seeds weigh 30·6 grammes (*Dicoccum*).

Number of seeds in 1 lb.—14,800.

Germination capacity—61 to 91 per cent in ten days.

Yield—The irrigated crop will yield 1,500 lb. to 1,700 lb. Dry Crop 400 to 800 lb.

MAIZE.

(*Zea Mays.*)

Tamil	Makka Cholam, Thulukka Cholam
Telugu...	Mekka Jonnalu.
Malayalam	Makka Cholam.
Kanarese	Mekke Jola.
Oriya	Mokka.
Tulu	Jola.

Area in Madras--130,250 acres.

Introduced varieties are occasionally met with. It is cultivated on a very limited scale as a field crop: as for instance in the Kistna delta on lands too high for irrigation. It is sown also in small patches to supply green cobs. It may also be grown for fodder.

Seed-rate—6 to 8 lb.; for fodder 20 lb.

Volume weight—1 M.M. weighs 3 lb.

Weight of grain—100 seeds weigh 30·4 grammes.

Number of seeds in 1 lb.—1,500.

Germination capacity—80 per cent.

Yield—Very variable: a good dry crop should give 1,200 to 1,500 lb.; 4,000 to 8,000 cobs.

KORALI.

(*Setaria Glauca.*)

Two varieties only.—(1) Samai Korali, a superior variety and (2) Korali, a common variety.

Grown specially on the Nilgiris. Sown in March and April and harvested in November and December. Thrashing is done by cattle power—Purely a rainfed crop, grown as pure crop.

The straw is greatly relished by cattle.

Seed-rate—50 M.M. per acre.

Volume weight—1 M.M. weighs 2·75 lb.

Husk to grain—75 per cent.

Germination capacity—90 per cent.

Yield—200 to 300 M.M. of grain and 600—800 lb. of straw.

PULSES.

BENGAL GRAM.

(*Cicer Arietinum.*)

Tamil	Kadalai.
Telugu	Sanagalu.
Malayalam	Kadalakka.
Kanarese	Kadale.
Oriya	Sullo Chonna.
Tulu	Kadale.

Area in Madras—121,100 acres.

Varieties are known with white, pale yellow, dark yellow or black grains. The crop is practically confined to the black soils. It is a late crop, sown after the rains. It is generally sown by itself, drilled or dibbled behind the plough, but may somtimes be broadcasted in mixtures.

Seed-rate—40 to 70 lb. per acre.

Volume weight—1 M.M. weighs 3·13 lb.

Husk to grain—20 per cent by weight.

Weight of seed—1,000 seeds weigh 133·94 grammes.

Number of seeds in 1 lb.—3,400.

Germination capacity—98 per cent.

Yield—300 to 700 lb. The refuse is a useful cattle food.

RED GRAM.

(*Cajanus Indicus.*)

Tamil	Tuvarai.
Telugu	Kandulu.
Malayalam	Tuvera.
Kanarese	Togari.
Oriya	Kandulo.
Tulu	Togori.

Area in Madras—285,500 acres.

There are numerous varieties which differ in the colour of their seed coats. A very widespread and hardy pulse ; sown early ; stops seven to nine months in the field. Practically always grown as a mixture, frequently in lines 4 feet to 6 feet apart with cereals. Dhal is a very valuable and important human food, while the husk is a good cattle food.

Seed-rate will vary with the mixture adopted: from 2 to 4 lb. per acre.

Volume weight—1 M.M. weighs 2·83 lb.

Husk to grain—20 per cent.

Weight of seed—1,000 seeds weigh 8·95 grammes.

Number of seeds in 1 lb.—6,600.

Germination capacity—76 per cent.

Yield—This will vary very much with the class of mixture ; 300 to 1,000 lb. per acre. The refuse (pods, leaves, etc.) obtained in the process of threshing is stacked and given to working cattle.

HORSE GRAM.

(*Dolichos Biflorus.*)

Tamil	Kollu or Kanam.
Telugu	Ulavalu.
Malayalam	Muthira.
Kanarese	Hurali.
Oriya	Kalutho.
Tulu	Kudu.

Area in Madras—1,861,700 acres.

There are varieties with black, grey or mottled seeds of various shades. The crop is sown pure on the poorest and thinnest red soils. It is found as a mixture with cotton in Nandyal and Tinnevelly. The grain is used for feeding cattle and horses, and is also eaten by man, it is a good fodder and green manure crop. The black variety is of short duration and is therefore sown late.

Seed-rate—15 to 20 lb. ; in the case of black horse gram it is 30 to 40 lb. Half the seed-rate or less if the seed is mixed. For fodder crop from 30 to 50 lb. per acre.

Volume weight—1 M.M. weighs 3·45 lb.

Weight of seed—1,000 seeds weigh 29·25 grammes.

Number of seeds in 1 lb.—15,500.

Germination capacity—90 per cent.

Yield—100 to 200 lb. in a mixture and 300 to 400 lb. if sown alone ; 500 lb. of dry fodder, including pods, etc.

FIELD BEAN.

(*Dolichos Lablab.*)

Tamil	Mochai.
Telugu	Anumulu.
Kanarese	Avarai.
Malayalam	Moccakotta.
Oriya	Bairo.
Tulu	Abare.

The seeds vary in colour from a dark red approaching black to a light cream almost white. Flowers white, occasionally purple.

It is a climbing plant which is always grown as a mixture, generally with some upstanding cereal like sorghum or kambu sown early in lines. A pure crop may be used to check weeds (smother crop).

Seed-rate—For a pure crop about 30 lb. would be needed. In mixtures 7 to 14 may be sown.

Volume weight—1 M.M. weighs 3·33 lb.

Husk to grain—21 per cent by weight.

Weight of seed—1,000 seeds weigh 256·94 grammes.

Number of seeds in 1 lb.—1,765.

Germination capacity—89 per cent.

Yield—100 to 200 lb. in a mixture ; 300 to 400 if sown alone.

GREEN GRAM.

(*Phaseolus Mungo.*)

Tamil	Paççapayaru.
Telugu	Pesalu, Paççapesalu.
Malayalam	Cherupayaru.
Kanarese	Hasaru.
Oriya	Puggo.
Tulu	Madenji.

Area in Madras—357,700 acres.

There are three varieties characterized by having green, yellow and black seeds. The crop is commonly grown throughout the Presidency, generally as a subsidiary crop to one of the cereals. It may be grown as a second crop on rice land or sown thick as a smother crop for weeds on irrigated land. The grain is held in high esteem.

Seed-rate—Up to 5 lb. in a mixture.

Volume weight—1 M.M. weighs 3·43 lb.

Husk to grain—24 per cent by weight.

Weight of seed—1,000 seeds weigh 29·22 grammes.

Number of seeds in 1 lb.—15,500.

Germination capacity—91 per cent.

Yield—150 to 200 lb. in a mixture.

BLACK GRAM.

(*Phaseolus Mungo* var. *Radiatus*, Hook.)

Tamil	Ulundu.
Telugu	Minumulu.
Malayalam	Uzhunnu.
Kanarese	Uddu.
Tulu	Urdu.

Area in Madras—186,800 acres.

The remarks under previous crop, which it closely resembles in appearance, yield and methods of cultivation, hold good. This suits a stiff soil.

Seed-rate—Up to 5 lb. in a mixture.

Volume weight—1 M.M. weighs 3·3 lb.

Husk to grain—11 per cent by weight.

Weight of seed—1,000 seeds weigh 46·3 grammes.

Number of seeds in 1 lb.—9,800.

Germination capacity—98 per cent.

DEW GRAM.

(*Phaseolus Aconitifolius.*)

Tamil ...	... Naripayaru, Kallupayaru, Tullikkapayaru.
Telugu ...	... Mittikelu.

There is only one variety; which is rather sparingly cultivated in Madras; it is a poor yielder, and is found generally as a mixture on the least fertile lands. The whole plant is a valuable fodder and is frequently grown, either alone or mixed with some millet, for this purpose exclusively. It may also be grown as green manure crop.

Seed-rate—$1\frac{1}{2}$ to 3 lb. per acre in mixture.

Volume weight—1 M.M. weighs 2·66 lb.

Weight of seed—1,000 seeds weigh 16·67 grammes.

Number of seeds in 1 lb.—27,200.

Germination capacity—91 per cent.

Yield—120 to 150 lb. in a mixture.

COW GRAM: COW PEA.

(*Vigna Catiang.*)

Tamil ...	... Karamani, Tattapayaru.
Telugu ...	... Alasandulu. Bobbarlu.
Malayalam	... Mampayaru, Kottapayaru.
Kanarese ...	... Avade.
Oriya ...	... Mamkododandi.
Tulu ...	... Lattane, Alasande.

A fairly common pulse as a mixed crop. The pods are prominent and large. A very useful green manure crop. It makes an excellent combination for cattle food when grown with cholam fodder.

Seed-rate—15 to 20 lb. as a pure crop. Half this for mixtures.

Volume weight—1 M.M. weighs 3·1 lb.

Husk to grain—10 per cent by weight.

Weight of seed—1,000 seeds weigh 128·2 grammes.

Number of seeds in 1 lb.—3,530.

Germination capacity—95 to 100 per cent.

Yield—300 to 400 lb. per acre in a pure crop.

VEGETABLES AND GARDEN PRODUCE.

BRINJAL.

(*Solanum Melongena.*)

Tamil	Kathri.
Telugu	Vankaya.
Malayalam	Vazhuthininga.
Kanarese	Badinekayi.
Oriya	Banjino.
Tulu	Badane.

There are many local varieties which differ in colour, shape, size and flavour. Introduced varieties from American seed have been tried but have not spread. The crop is grown all over the Presidency on garden lands, sometimes alone, but more often mixed with various vegetables or at the edges of betel gardens. The unripe fruits are used for making curries.

Seed-rate.—The crop is grown from transplanted seedlings. Between one and two pounds of seed sown in three-fourths of a cent, will plant one acre two feet apart both ways.

Yield—up to 20,000 lb. per acre for a good crop.

CLUSTER BEAN.

(*Cyamopsis Psoralioides.*)

Tamil	Kottavarai.
Telugu	Goruchikkudikaya.
Kanarese	Govardhanakayi.

The crop is of very little importance and is confined to mixtures in vegetable gardens. It is nowhere grown on a field scale.

PUMPKIN.

(*Cucurbita Maxima.*)

Tamil	Pushinikkai : Parangikkai : Sakkarai Pushinikkai.
Telugu	Gummadikaya.
Malayalam	Mattanga.
Tulu	Kumbuda : Kembude : Kancholu.

There are several varieties differing in shape, size and colour of fruits. There are also varieties which are sown in summer and in the rains. It is chiefly a rainy weather crop. The ripe and unripe fruits are used as vegetables for making curries. The ripe fruits keep for months. It is usually grown near the hedges in field margins : but occasionally may be found as a field crop.

CUCUMBER.

(*Cucumis Sativus.*)

Tamil	Velliri.
Telugu	Dosakaya.
Kanarese	Sonthikayi.
Tulu	Tante.

There are many local varieties which differ in colour, shape, size, flavour and keeping quality of the fruit. The crop is commonly grown mixed with all crops in black soils

of Kistna district. It is also grown in tank beds when tanks get dry in the beginning of summer. It is very common on the West Coast. Near Madras occasionally on a field scale.

The fruits are eaten fresh or cooked. The variety cultivated in Kistna district can be dried and preserved, and is often used in making pickles.

MELON.

(*Cucumis Melo.*)

Tamil	Mulampazham : Karbujapazham.
Telugu	Karbuja pandu.
Malayalam	...
Kanarese	Karbuja hannu.
Tulu	Tekkarpe : Tekkare.

There are a number of melons grown in tank beds or in the sandy beds of rivers, in the hot weather, many of which have local reputaion, e.g., Cuddapah melons, Siddhout melons. They are generally heavily manured and hand-watered.

VEGETABLE MARROW.

(*Cucurbita Pepo.*)

Tamil ... ... Simapushini or Simaparangi.

There are several varieties differing in size and shape of the fruit. Occasionally met with in vegetable gardens.

MUSK MELON.

(*Cucurbita Moschata.*)

Tamil ... ... Arasanikai.

This variety is found in the Coimbatore district.

WATER MELON.

(*Citrullus Vulgaris.*)

Tamil	Piçça pazham : Karbuja.
Telugu	Kalangadi pandu : Puçça pandu.
Kanarese	Baççangayi.
Tulu	Baççangayi.

A large green water melon with dark mottled green skin and pinkish flesh with black seeds.

The ripe fruits are sold in the hot weather in the bazaars.

LADIES' FINGERS.

(*Hibiscus Esculentus.*)

Tamil	Vendaikay.
Telugu	Bendakaya.
Kanarese	Bendakayi.
Tulu	Bendekayi : Bendayi.

This is grown as a small percentage in a mixture in vegetable and other gardens for the sake of its unripe fruits. It is nowhere very extensively grown, though found all over the Presidency, especially near large towns. It has been recommended as a "trap crop" for cotton pests.

Seed-rate—5 to 10 lb. when the crop is to be transplanted.

SWEET-POTATO.

(*Ipomœa Batatas.*)

Tamil	Sakkaraivallikizhangu or Chinikizhangu.
Telugu	Genusugaddalu.
Malayalam	Chakkarai kizhangu.
Kanarese	Genusu.
Oriya	Kondamulo.
Tulu	Kerang.

A white skinned and a red skinned variety are known.

The crop is grown extensively throughout Madras as a garden crop, preferably on deep sandy soils. The mature vines are cut into lengths with generally three nodes, and planted on ridges or flat beds. Care must be taken to see that the spreading plants do not root at the nodes. It is commonly used as food, either cooked in curry or boiled, roasted or fried. The vines are good cattle food.

Seed-rate—20,000 to 35,000 sets per acre.

Yield—8,000 to 12,000 lb. per acre.

TAPIOCA.

(*Manihot Utilissima.*)

Tamil	Maravallikizhangu.
Telugu	Karra pendalam.
Malayalam	Marachini.

The crop is grown fairly widely from cuttings in the sandy soils of South Arcot, Chingleput and Nellore, and occasionally further north along the littoral tracts. It is grown largely on the West Coast. In South Arcot a good crop weighed fresh 13,000 lb. an acre.

ELEPHANT YAM.

(*Amorphophallus Campanulatus.*)

Tamil	Karakkaranai: Shenaikizhangu.
Telugu	Thiyyakanda.
Malayalam	Senai.

On the West Coast, this is cultivated on dry land often mixed with ginger as a rain-fed crop; also in the compounds of houses where it may receive occasional irrigation. In Coimbatore, it forms a subordinate crop in turmeric.

Seed-rate—About 1,500 lb. of corms per acre.

Yield—About 15,000 lb. per acre.

DIOSCOREA.

The true yam is grown occasionally in betel gardens, etc. It is fairly common on the West Coast.

COLOCASIA.

(*Colocasia antiquorum.*)

Tamil	Sheppankizhangu or Shamakkizhangu.
Telugu	Shamagadda.
Malayalam	Chempakizhangu.
Kanarese	Chamagadda.
Tulu	Tevu.

There is a variety without acridity occurring rarely in Malabar. The area under this crop is limited and it is confined to rich garden lands and backyards, with the exception of the West Coast, where it may be grown as a dry crop. In Chingleput, this occurs as a pure crop on good sandy loams, where it is heavily manured with cattle manure and copiously watered. In Tanjore it is grown as a field crop, either pure or mixed with yams and other vegetables. It is grown in trenches or pits and needs heavy manuring when it is most profitable returning up to forty-fold. The corms are cooked and made into curry. Red soil is said in Chingleput to produce round tubers.

Seed-rate—600 lb. of corms.

Yield—8.000 to 10,000 lb.

TYPHONIUM TRILOBATUM.

Tamil	Karanaikizhangu.
Telugu	Kanda.
Oriya	Ullo.
Tulu	Kene.

This is cultivated in small quantities in Chingleput and Chittoor. The root is acrid. The acridity is removed by boiling the root with tamarind water. It has a reputation as a remedy for piles.

Seed-rate—500 to 600 lb. per acre.

ARROW-ROOT.

(*Curcuma angustifolia.*)

Tamil	Araruttu.
Telugu	Palagunpa.
Malayalam	Kuvva.
Kanarese	Kuvegida.
Oriya	Palu.
Tulu	Kooveda dayi.

The cultivation is very limited and the crop is found only in Ganjām, parts of the Circars and the West Coast. It is grown on well-manured sandy soils.

Seed-rate—About 700 lb. per acre.

Yield—4,000 to 8,000 lb. of tubers. 100 lb. of tubers produce about 12½ lb. of flour.

POTATO.

(*Solanum tuberosum.*)

Tamil	Urulaikkizhangu.
Telugu	Urula gadda.
Malayalam	Urula kizhangu.
Kanarese	Urula gadda.
Tulu	Batate.

The varieties are numerous. The crop is confined to the hills, since the temperature of the plains is too high for it to be grown profitably. It is an increasingly important crop on the Nilgiris.

Seed-rate—900 to 1,000 lb. per acre.

Yield--5 to 6 tons.

CEPHALANDRA INDICA.

Tamil	Kovai.
Telugu	Dondai.

There are two varieties, one is wild and is bitter, and the other cultivated which is sweet. It is said that the fruits lose bitterness under cultivation. In the Circars, it is cultivated and the fruit is used as a vegetable. Elsewhere it is commonly found wild, growing on bushes and hedges. The ripe fruit may be gathered as it becomes sweet.

AMARANTH.

(*Amaranthus gangeticus.*)

Tamil	Kiraithandu.
Telugu	Thotakoora.
Malayalam	
Kanarese	

This is grown as a mixed crop in vegetable and backyard gardens. The whole plant is generally pulled out and sold.

There is another variety which goes by the name *A. Paniculatus*, and which is grown on the hills for the sake of its grain which is parched and made into flour and eaten. It is also used for making sweetmeats.

Weight of seed—1,000 seeds weigh ·82 gramme.

Number of seeds in 1 lb.—553,000.

SNAKE GOURD.

(*Trichosanthes anguina.*)

Tamil	Pudalangai.
Telugu	Potlakaya.
Malayalam	Padavalanga.

This gourd is cultivated commonly throughout India as a rainy season crop in backyards and occasionally on garden lands. There are varieties differing in the size of the fruit and its colour : length. 5 feet to 2 feet : colour from light to dark green, occasionally with lighter stripes. The ripe fruit is deep orange in colour externally and the pulp inside in which the seeds are imbedded is scarlet. This fruit is largely used as a vegetable especially when tender and unripe.

BITTER-GOURD OR CARILLA FRUIT.

(*Momordica charantia.*)

Tamil	Pavakkai.
Telugu	Kakarakaya.
Malayalam	Kaippakka.

The fruits are slightly bitter and are largely used in making curries. There are several cultivated forms which differ in size and colour of the fruit ; some forms have long warty fruits varying in length from 4 inches to 12 inches while others produce small fruits varying from ½ to 1 inch. Colour varies from light to dark green. The fruit is supposed to be a good tonic and stomachic.

CALABASH OR CALABASH-CUCUMBER.

(*Lagenaria vulgaris.*)

Tamil	Sorakkai.
Telugu	Sorakaya.
Malayalam	Churaka.

An exotic but now largely cultivated in India. Unlike the other gourds this has white flowers. The unripe fruits, just before the outer skin becomes thick, form a good vegetable if seasoned. When fully ripe the rind of the fruit becomes very hard and woody and then it makes an excellent vessel or flask.

ASH-GOURD OR ASH-PUMPKIN.

(*Benincasa cerifera.*)

Tamil	Kalyana pushini.
Telugu	Budutha gummidi or Pendli gummidi.
Malayalam	Kumbalam.

This is another gourd very widely cultivated all over India. The fruits are usually large (1 to 1½ feet long), up to 25 lb. in weight, smooth but covered with whitish bloom. When fully ripe the rind becomes hard and the fruits keep well for a long time.

RIBBED-GOURD.

(*Luffa acutangula.*)

Tamil	Peerkan.
Telugu	Beera.

The fruit is very largely used in curries, when it is about half-mature and it is considered to be one of the best of the indigenous vegetable plants. The fruits grow to about one foot and have sharp ridges externally. It is cultivated all over India.

LOOFAH

(*Luffa aegyptiaca.*)

Tamil	Norai Peerkan.
Telugu	Gutti beera or Nuna beera.

Though not a native of India, it is widely cultivated and has become naturalized. This differs from the ribbed-gourd in not having the sharp ridges, but in other respects both are similar. The net work of vascular bundles forming the frame work of the pericarp in the fruits of this and the ribbed-gourd forms the loofah of commerce.

GUINEA GRASS.

(*Panicum maximum.*)

A fodder crop which has been introduced successfully in parts of Madras. The crop is usually propagated by portions separated from the root stocks, which become overgrown and need division. The roots should be set out evenly in rows running in both directions spaced 3′ × 3′ or 2′ × 2′ to ensure through inter-cultivation. The plant needs copious irrigation and liberal manuring; it is quick growing and ordinarily eight cuttings can be had in a year. 500 slips weigh 40 lb. and fill one gunny bag.

Yield.—25,000 to 40,000 lb. of green fodder per acre per annum in 8 cuttings.

ELEPHANT GRASS.

(*Pennisetum purpurea.*)

Another fodder crop, which has been introduced successfully in some places. Should be planted in ridges as slips about 1½ feet apart, 10,000 to 12,000 slips per acre. The cost of 10,000 slips is Rs. 12-3-0. After cutting should be bullock hoed with a Junior hoe. The first cutting is obtained four months after planting and subsequent cuttings every three or four months. The average yield is 45,000 lb. per acre. Can be kept as a permanent crop for several years if kept cultivated. Occasionally manured.

LUCERNE.

(*Medicago sativa.*)

An excellent fodder but rather difficult to grow extensively. A deep calcareous soil is needed and it must be irrigated. Seed may be broadcasted or drilled. 8 to 20 lb. per acre. Seed weight 205,000 to the lb. The average yield is 50,000 lb. When well established will give 8 to 70 cuttings a year.

OIL SEEDS.

GINGELLY.

(*Sesamum indicum.*)

Tamil	Ellu.
Telugu	Nuvvulu.
Malayalam	Ellu.
Kanarese	Yellu.
Oriya	Rasi.
Tulu	Yenme.

Area in Madras—774,680 acres.

There are several local varieties which differ in their period of growth, time of sowing and the colour of their seed. The crop is grown throughout the Presidency generally as an early crop. It is seen on the driest and poorest soils, on the richest delta lands and on paddy fields as a second crop. Owing to the small size of the seed it is sometimes difficult to get a full plant.

Seed-rate—2 to 3 lb.; less if drilled.

Volume weight—1 M.M. weighs 2·57 lb.

Weight of seed—1,000 seeds weigh 2·61 grammes.

Number of seeds in 1 lb.—172,800.

Germination capacity—90 per cent.

Yield—350 to 450 lb.; but of course this will vary very much according to the conditions under which it is grown.

Percentage of oil—40 per cent by weight.

CASTOR.

(*Ricinus communis.*)

Tamil	Amanakku: Kottai-muthu.
Telugu	Amudalu.
Malayalam	Avanakku.
Kanarese	Haralu.
Oriya	Kallo.
Tulu	Almbudathakayi.

Area in Madras—380,400 acres.

There are numerous varieties, annual, biennial and perennial, grown either as garden or dry crops, and either green or red in colour. As a dry crop, castor occupies the poorest red soil, alone or mixed with one of the inferior millets or grams. As a perennial, it is dibbled along the edges of sugarcane and betel vine and other garden crops. It is generally sown in fields in lines.

Seed-rate—10 to 20 lb. per acre.

Volume weight—1 M.M. weighs 2·87 lb.

Weight of seed—1,000 seeds weigh 346·71 grammes.

Number of seeds in 1 lb.—1,308.

Germination capacity—80 per cent.

Yield—200 to 300 lb. as dry crop in poor lands, up to 700 lb. in more favourable surroundings.

Percentage of oil—46, but ordinary extraction gives 36. The cake is an excellent manure.

GROUNDNUT.

(*Arachis hypogea.*)

Tamil	Verkadalai : Nilak-kadalai.
Telugu	Vershanagalu : Nelashanagalu.
Kanarese	Nilakkadala.
Tulu	Nilakkadale.

Area in Madras—1,696,850 acres.

The Mauritius variety has practically displaced the old local variety; other varieties may be seen on trial at the Palur Agricultural station.

The crop suits sandy soils, and is either sown as a dry rain-fed crop, when it is mixed with some cereal, or raised under irrigation mixed with ragi.

Rain-fed crop :—June-July to December-January. Irrigated crop : February-March to July-August. The crop is very profitable, and its area has increased rapidly in the last few years.

Seed-rate—50 to 75 lb. good shelled seed.

Volume weight—1 Madras measure of unshelled nuts weighs $1\frac{3}{4}$ lb. 1 Madras measure of shelled nuts weighs $2\frac{1}{2}$ lb. 1 Madras measure of oil is $3\frac{1}{3}$ lb.

Weight of seed—100 seeds weigh 43 grammes.

Number of seeds in 1 lb.—1,000.

Yield—Dry average 1,300 lb. per acre. Irrigated crop as much as 2,500 lb.

Percentage of oil—As extracted by country mill is 36 to 40, actual contents up to 50 per cent.

Proportion of shell to kernels—25 per cent by weight, being a little higher in the case of dry rain-fed crop.

NIGER SEED.

(*Guizotia abyssinica.*)

Tamil	Peyellu : Uchchellu.
Telugu	Verrinuvvulu : Valiselu : Ojurellu.
Kanarese	Huchellu.

A black oil seed grown occasionally as a mixture in the western and northern taluks of Bellary, and in the uplands of the Circars, Salem, Coimbatore, etc.

Seed-rate—About one pound of seed is mixed with a cereal.

Weight of seed—1,000 seeds weigh 4·55 grammes.

Number of seeds in 1 lb.—100,000.

Yield—About 300 lb. may be expected from an acre.

Percentage of oil—35 by extraction.

LINSEED.

(*Linum usitatissimum.*)

Tamil	Alivirai.
Telugu	Avisi.
Kanarese	Alasi.

Area in Madras—7,300 acres.

This is only grown for its seed, which yields a valuable oil: the fibre is not extracted. The crop is found mostly in the Bellary portion of the Deccan upland, mixed with other crops like safflower or wheat.

Seed-rate—15 to 20 lb. per acre.

Volume weight—1 M.M. weighs 2·87 lb.

Weight of seed--100 seeds weigh 6·4 grammes.

Number of seeds in 1 lb.—70,900.

Yield—300 to 400 lb. of seed per acre.

Percentage of oil—about 30 when pressed in the ordinary country mills.

SAFFLOWER.

(*Carthamus tinctorius.*)

Tamil	Kasumbavirai.
Telugu	Kusumbalu.
Kanarese	Kusumba.
Tulu	Kusumadapu.

The plant may be grown both for its oil and also for the dye which can be extracted from the flowers, though there is little or no extraction done now in Madras. The foliage of the plants ordinarily met with is thickly armed with spines. There is also a smooth-leaved variety. The cultivation is confined to the black soils of the Ceded Districts, where it is frequently seen sown on the head-lands, partly to prevent cattle trespass, and partly because it can be sown late. The oil is very clear and is used in cooking; also to adulterate ghee.

Seed-rate—5 to 10 lb.

Volume weight—1 M.M. weighs 2·43 lb.

Weight of seed—1,000 seeds weigh 41·27 grammes.

Number of seeds in 1 lb.—11,000

Yield—400 lb. per acre.

Percentage of oil—30 ; ordinary methods extract 20 per cent. The cake is used as a cattle food and is said not to get mouldy readily.

FIBRES.

COTTON.

(*Gossypium herbaceum ; Gossypium indicum ; Gossypium obtusifolium ; Gossypium hirsutum.*)

Tamil	Paruthi.
Telugu	Parthi.
Malayalam	Parutti.
Kanarese	Hatti.
Oriya	Koppa.
Tulu	Parti.

Area in Madras—2,305,920 acres.

The two common varieties grown as annuals on the black cotton soils are *G. herbacuem* (Tellapathi; Uppam ; Ukkam) and *G. indicum* (Yerrapathi ; Karunganni). Besides these, *G. obtusifolium* (Nadam) is found in parts of Coimbatore, while in the same tract are found the remains of the early introduction of American cotton in the shape of *G. hirsutum* (Bourbon) ; both these are perennial.

All the above are dry crops and occupy generally the black cotton soils, though Yerrapathi is found on reddish soils, and the two last are found on lightish gravelly soils.

Seed-rate—5 to 15 lb. per acre ; rate varies in different Localities and also with the soils.

Volume weight—(Uppam) 1 M.M. weighs 2·1 lb.

Weight of seed—(Uppam) 1,000 seeds weigh 49·2 grammes.

Number of seeds in 1 lb.—(Uppam) 9,220.

Yield—300 to 450 lb. Nadam 300 lb. a year for 2½ years.

Ginning percentage—22 per cent up to 26 per cent. In selected strains up to 33 per cent.

CAMBODIA COTTON.

(*Gossypium hirsutum.*)

This is a recently introduced cotton which has spread from the south, and now occupies a very considerable area. It should be grown normally as an irrigated crop, and will repay good treatment. Very good samples of Kappas may be obtained from the soils at the foot of the hills, as in Madura district, but Cambodia does not take kindly to black soils. Seed is sown at the beginning of the north-east monsoon.

Seed-rate—10 to 20 lb.

Germination capacity—90 per cent.

Yield—700 to 1,500 lb. per acre : cases have been reported where the yield has been over 2,000 lb.

Ginning percentage—30 to 33 per cent.

DECCAN HEMP : BIMLIPATAM JUTE.

(*Hibiscus cannabinus.*)

Tamil	Pulicchai or Pulimanji.
Telugu	Gogu.
Kanarese	Pundi.

Area in Madras—60,400 acres.

There are several varieties distinguished by the colour of the stem and leaf which is either green or wholly or partly red. The shape of the leaves also varies being either entire or palmately divided. The crop is grown very commonly as a slight mixture in almost any crop, the leaf being used for curry. As a pure crop, its cultivation is confined to parts of Guntūr and Vizagapatam. Tests at Coimbatore have shown that there the red stemmed green veined variety with divided leaves is the best for fibre.

Seed-rate—25 to 30 lb. per acre.

Volume weight—1 M.M. weighs 2·63 lb.

Weight of seed—1,000 seeds weigh 24·5 grammes.

Number of seeds in 1 lb.—18,500.

Yield—600 to 1,000 lb. dry fibre.

Percentage of fibre to dry stalks—16 to 17.

Percentage of fibre to green stalks—4.

SUNNHEMP.

(*Crotolaria juncea.*)

Tamil	Sanappu or Shanal.
Telugu	Janumu.
Malayalam	Wuckoo.
Kanarese	Sonabu.
Oriya	Soin.
Tulu	Talambu.

Area in Madras—112,900 acres.

The crop is found very extensively as a mixture throughout the uplands of Kistna and Guntūr and pure as a second crop after paddy in the deltas. It is grown as a pure crop in parts of Gōdāvari, Tinnevelly and Chingleput Its use as a green manure crop is rapidly extending, and has caused a heavy demand for seed. The fibre is used for making gunny bags, tails of mhote buckets, harness of pack bullocks, etc. Fishing nets in coastal tracts are exclusively made of this.

Seed-rate – 40 to 60 lb. up to 100 to 150 lb. in places.

Volume—weight—1 M.M. weighs 3·12 lb.

Weight of seed—1,000 seeds weigh 46·4 grammes.

Number of seeds in 1 lb.—9,800.

Yield—500 to 800 lb. of fibre ; grown as a seed crop 400 to 600 lb. of seed may be expected.

Percentage of fibre to dry stem—8·2 per cent.

AGAVE.

(*Agave vera Cruz : Agave sisalana.*)

Tamil	Anaikkattazhai, Kattazhai.
Telugu	Kalabanda.
Malayalam	Wakkuchan.

The American or Railway aloe (misnamed) is commonly seen in all parts of the Presidency as a hedge plant. It is generally propagated by means of plantlets which arise as suckers on the roots of the older plant, or by bulbils.

Attempts have been made to grow the sisal agave on a large scale but without much success. It can only pay when rents are low; on such lands, difficulties are often felt in the extraction of the fibre for want of water. The fibre is excellent.

Yield—Each plant will produce 15—20 leaves a year. The average weight of each leaf being 6 lb., 900 plants per acre will give at this rate and with 3½ per cent fibre, 300 lb. of dry fibre per acre per annum.

CONDIMENTS AND SPICES.

CHILLIES.

(*Capsicum annuum, Watt.*)

Tamil	Milagai.
Telugu	Mirapakaya.
Malayalam	Molaku.
Kanarese	Menasinakayi.
Oriya	Lonkamonho.
Tulu	Munuchi.

Area in Madras—327,050 acres.

There is one common variety, though special races from particular districts are recognized for their good qualities. The plant is generally transplanted from a seed bed, and is usually grown on garden lands, as a pure crop or as a mixture in a vegetable garden. On dry soils it is an important crop in Guntūr and the uplands in the Gōdāvari and Kistna, where it is grown in large fields which are most accurately transplanted to allow of careful inter-cultivation. The pods are picked and dried for marketing.

Seed-rate—1 to 1½ lb. to transplant an acre.

Volume weight—1 Madras measure of dried fruits weighs ½ lb.

Weight of seed—1,000 seeds weigh 5·65 grammes.

Number of seeds in 1 lb.—80,300.

Yield—2,000 to 2,500 lb.

ONIONS.

(*Allium cepa.*)

Tamil	Vengayam, Irulli.
Telugu	Ulligadda, Nirulli.
Malayalam	Chuvannaulli.
Kanarese	Irulli, Ulligadda.
Oriya	Pizago.
Tulu	Nirulli.

Area in Madras—37,900 acres.

The common onion grown in Madras is of a reddish colour. It is raised from seed which is sown in a seed-bed ; the seedlings being planted out in beds or ridges, or is raised from bulbs which are planted preferably on ridges. The latter method is obviously wasteful. White onions from Dhulia in Bombay have been grown successfully. The Bellary onion has a special reputation.

Seed-rate—10 lb. carefully sown in a nursery will be enough for an acre. The seed is delicate and must be fresh as it very quickly deteriorates. For bulb planting about 1,000 lb. will be sufficient to plant an acre.

Volume weight—1 Madras measure of seed weighs 2 lb.

Weight of seed—1,000 seeds weigh 3·95 grammes.

Number of seeds in 1 lb.—114,800.

Yield—15,000 to 25,000 lb. per acre. About 15 to 25 per cent of dryage will occur on storing for three months. Onions are rarely kept for more than three or four months, either for consumption or for planting.

GARLIC.

(*Allium sativum.*)

Tamil	Vellaipundu.
Telugu	Tellagadda : Velluli.
Malayalam	Vellulli.
Kanarese	Bellulli.
Oriya	Losono.
Tulu	Bollulli.

Area in Madras—12,500 acres.

A rare field crop which is only occasionally seen. It is raised from bulbs. The treatment is similar to that outlined for onions. As a food, garlic is almost universally used in curries on account of its varied medicinal properties. It is a more valuable crop than onion and can be kept much longer.

Seed-rate—500 to 700 lb. of bulbs will be sufficient to plant an acre.

Yield—8,000 to 10,000 lb. per acre.

TURMERIC.

(*Curcuma longa.*)

Tamil	Manjal.
Telugu	Pasupu.
Malayalam	Manjal.
Kanarese	Arashina.
Oriya	Holodi.
Tulu	Manjal.

Area in Madras—46,000 acres.

There are no distinct varieties though the rhizomes from different localities show slight differences.

An irrigated crop grown in wet or garden lands ; needing a deep fertile, well-drained soil; occupies the ground for nine months. It is usually planted in rows by hand on ridges; and generally mixed with yams, castor, etc. Castor gives the necessary shade and supplies some fuel for curing.

Seed-rate—1,000 to 1,700 lb. per acre.

Yield—12,000 to 20,000 lb. of green roots which when cured and dried will weigh 3,000 to 5,000 lb approximately.

CORIANDER.

(*Coriandrum Sativūm.*)

Tamil	Kottumalli.
Telugu	Dhaniyalu or Kottumeri.
Mālayalam	Kottumpalari.
Kanarese	Kothumbaribija.
Oriya	Dhonnia.
Tulu	Kottemberi.

Area in Madras—73,300 acres.

There is only one variety, which is grown on a field scale principally on black soils, and as a mixture with cotton and other crops. In deep and heavy black soils, in parts of Tinnevelly district, this is grown pure in extensive fields where it rotates with kambu and gives heavy yields. Occasionally grown in gardens for seed, and also as a vegetable for the sake of the leaves.

Seed-rate—10 to 12 lb. for a pure crop; 2 to 4 lb. in mixtures.

Weight of seeds—1,000 mericarps (i.e., 500 fruits) weigh 7·31 grammes.

Nnmber of seeds in 1 lb.—62,000.

Yield—about 350 lb. per acre.

CUMMIN.

(*Cuminum cyminum.*)

Tamil	Siragam.
Telugu	Jilakara.
Malayalam	Jirakam.
Kanarese	Jirige.
Tulu	Jerridari.

This is a valuable and delicate crop raised in gardens; it requires much care, fine tilth and a firm seed-bed: grown in two seasons, beginning of south-west and end of north-east monsoons: wants thorough manuring and light watering and mild climate. Hence cultivated in limited extent in Coimbatore and elsewhere in Madura and in Cuddapah-Kurnool. A rich loam fairly well-drained is preferred: two months crop.

Seed-rate—20 lb. per acre.

Weight of seed—1,000 seeds weigh 3·97 grammes.

Number of seeds in 1 lb.—114,250.

Yield—up to 750 lb. of seed (fruits).

OMUM—BISHOPS WEED.

(*Carum copticum.*)

Tamil	Ashamadhan : Omum.
Telugu	Omu : Omamu.
Kanarese	Omu.
Malayalam	Ayamodakam.

A crop of very minor importance agriculturally. Grow occasionally as a field crop in parts of the Nandyal valley an as a mixture on black cotton soils in Tinnevelly.

MUSTARD.

(*Brassica juncea.*)

Tamil	Kadugu.
Telugu	Avalu.
Malayalam	Katuku.
Kanarese	Sasive.
Oriya	Soriso.
Tulu	Dasemi.

Area in Madras—11,800 acres.

The area under this crop is small. It is found in parts o Salem and Coimbatore uplands, and as a cold weather crop i Ganjām and on the Kistna lankas. It is always grown as mixture.

Seed-rate—4 to 6 lb.

Weight of seed—1,000 seeds weigh 1·78 grammes.

Number of seeds in 1 lb.—254,800.

Yield—400 lb.

PEPPER.

(*Piper nigrum.*)

Tamil	Milagu.
Telugu	Miriyalu.
Malayalam	Kurumulaku.
Kanarese	Olleminasu.
Tulu	Sedde Munuchi.

Area in Madras— 83,000 acres.

The following varieties are grown: Balamcotta, Kaluvalli and Cheriya Kodi. An inferior female variety (others are all hermaphrodite) called Utherankotta is often seen in gardens. The crop is confined to the West Coast, mostly North Malabar and the Wynaad. Cuttings are planted against standards. The crop is perennial and commences to bear after the third year up to the 15th or 20th when it declines. (See Reports of the Taliparamba Agricultural Station.)

Volume weight—1 Madras measure of green pepper weighs 1 lb. when dry.

Weight of seed—1,000 seeds weigh 51·5 grammes.

Number of seeds in 1 lb.—8,800.

Yields in the Wynaad about 5 cwt. per acre, up to 15 cwt.; in the low country 2 to 3 cwt. is a good yield.

GINGER.

(*Zingiber officinale.*)

Tamil	Inji.
Telugu	Allam.
Malayalam	Inchi.
Kanarese	Hasisuntni.
Oriya	Vodda.
Telu	Soonti.

The cultivation is practically confined to the West Coast where it is grown on the high lands and heavily manured with leaves. In the Circars, occasionally under shade for green ginger. A variety of ginger with the smell of mangoes is occasionally found and is called mango ginger. This is used for making pickles and chutnies.

Seed-rate—1,200 to 2,000 lb. of green rhizomes.

Yield—up to 40,000 lb. of green ginger which will give 2,000 lb. of dry ginger.

FENUGREEK.

(*Trigonella faenumgraecum.*)

Tamil	Venthiam.
Telugu	Menthulu.
Malayalam	Uluma.
Kanarese	Menthiya.
Oriya	Methi.
Tulu	Mente or Metti.

This is grown in gardens and is a three months' crop. It is found near towns as a pot herb in gardens. The seed is used for flavouring curries and is also used medicinally.

Weight of seed—1,000 seeds weigh 11·75 grammes.

Number of seeds in 1 lb.—38,600.

Yield—600 up to 850 lb.

CARDAMOM.

(*Elettaria cardomomum.*)

Tamil	Elakkai.
Telugu	Yelakkayulu
Malayalam	Elam.
Kanarese	Yalakki.
Tulu	Elakki.

Area—(1903) Madura—4,000 acres : 650,000 lb.
Malabar—1,500 acres : 245,000 lb.
South Kanara—1,260 acres : 68,800.
Coorg—1,100 acres : 50,000 lb.

Its cultivation is practically confined to the hills, where it is grown by planters at a considerable elevation, and also in the submontane tracts of Madura and West Coast where the rainfall is heavy. The crop wants partial shade and a humous soil : it is perennial.

Yield—150 to 300 lb. per acre in an year.

DRUGS AND NARCOTIC.

BETEL.

(*Piper betel.*)

Tamil	Vettilai.
Telugu	Tamalapakulu.
Malayalam	Vettila.
Kanarese	Vilidele.
Oriya	Panno.
Tulu	Baccire.

Area in Madras—27,100 acres.

The varieties grown are numerous, but their names vary from district to district. The crop is a three years' one, and needs constant attention and careful manuring and irrigation. It is usually trained to climb the living stalks of *Agathi grandiflora*, grown for this purpose: it is also trained up bamboos. It is planted from cuttings.

Yield is said to be 80 lakhs of leaves per acre per annum after the first year, but it is very difficult to get accurate figures.

TOBACCO.

(*Nicotiana tabacum.*)

Tamil	Pugaiyilai.
Telugu	Pogaku.
Malayalam	Pukayila.
Kanarese	Hogesoppu.
Oriya	Dhuma.
Tulu	Pugere.

Area in Madras—220,230 acres.

There are numerous local varieties differing in the shape of the leaf, the thickness of the leaf or the midrib and the quality or flavour of the leaf.

The crop is grown extensively. It is sometimes seen as a dry crop, but is more often irrigated though probably the largest crops are obtained on unirrigated lands on the Gōdāvari lankas. The crop is often sold standing as the processes of curing and fermenting are difficult.

Seed-rate—2 oz. of seed mixed with fine sand will sow 200 square feet of seed-bed and will plant out an acre.

Weight of seed—1,000 seeds weigh ·095 gramme.

Number of seeds in 1 lb.—4,775,000.

Yield—900—2,000 lb. of cured leaf.

INDIAN HEMP.

(*Cannabis sativa.*)

Tamil	Ganja.
Telugu	Ganjaya : Ganja : Bangiku.
Malayalam	Kanjavacheti : Kanjavu.
Kanarese	Bhangi : Ganja.
Tulu	Bangi : Ganja.

Area in Madras—300 acres.

It is cultivated only under the supervision of the Abkāri Department. The success of the crop depends on the complete elimination of the male plants, as the narcotic principle is only developed to any extent in the unfertilized female plant.

Yield—is said to be up to 200 lb. of prepared ganja in the hills: experimental crops at Coimbatore gave 700—800 lb. per acre.

TINNEVELLY SENNA.

(*Cassia angustifolia.*)

Tamil	Surat Nilavirai : Nilavakai.
Telugu	Nelatangedu.

Area in Madras—6,150 acres.

The crop is grown for its leaves which are used medicinally and is found mainly in Tinnevelly in dry, wet or garden lands. Flowers appear after two months and are nipped off, and leaves are first gathered four or five months from the time of sowing. After picking, the leaves are cured under shade for seven days, when they are bagged and sold. The crop lasts on dry land for three years.

Seed-rate—4 to 5 Madras measures.

Weight of seed—1,000 seeds weigh 22·6 grammes.

Number of seeds in 1 lb.—20,000.

Yield—Dry lands, 1st year, 700 lb., second and third half or less; wet and garden lands—1,400 lb.

SUGARS.

SUGARCANE.

(*Saccharum officinarum.*)

Tamil	Karumbu.
Telugu	Cheruku.
Malayalam	Karimbu.
Kanarese	Kabbu.
Oriya	Akku.
Tulu	Karumbu.

Area in Madras—113,180 acres.

There are numerous varieties and one variety may often be known by different names in different districts. Besides the local canes, there are a number of Mauritius canes and sports from them which are being widely cultivated in certain tracts. There are further the seedling canes raised from seed in various countries, from which they have been obtained, namely, Barbados and Java. Indian seedlings are now being raised on a large scale at the Government of India Sugarcane Station near Coimbatore.

This is the chief sugar crop although sugar is obtained from the juice of the palmyra, date and coconut palm. It is a twelve-month crop which requires irrigation throughout, and can only be successfully grown on well-drained garden or wet lands of high fertility which must be well-manured.

Seed-rate—10,000 to 35,000 setts (cuttings). These should be cut from the top halves of the cane. Each sett should have at least two if not three joints. Jaggery is manufactured by boiling down the juice extracted by milling the canes in mills with iron rollers.

Extraction—60—70 per cent by weight of the cane is extracted by a good iron roller in form of juice.

Proportion—jaggery to juice: 11—13 per cent.

Yield—4,000 to 10,000 lb. of jaggery.

DYES.

INDIGO.

(*Indigofera Sumatrana.*)

Tamil	Avuri: Nili.
Telugu	Nili.
Malayalam	Nilam.
Kanarese	Nili.
Oriya	Nili.
Tulu	Neeli.

Area in Madras—128,900 acres.

There is only one variety grown in Madras. Its cultivation is steadily decreasing; but the crop is still found on a fair scale in Vizagapatam, Guntūr, Kurnool, Cuddapah and South Arcot, where the high prices obtainable for the refuse help to keep the industry going. Two or three cuttings are obtained from each crop.

Seed-rate—10 to 15 lb. per acre.

Volume weight—1 M.M. weighs 3 lb.

Weight of seed—1,000 seeds weigh 5·85 grammes.

Number of seeds in 1 lb.—77,500.

Yield—9,000—12,000 lb. green stuff of which 40 per cent should be leaf, and this should give 27 to 30 lb. dry indigo; as much as 80 lb. may be obtained.

CHAYROOT.

(*Oldenlandia umbellata.*)

Tamil	Chayaver.
Telugu	Chiriverulu.
Malayalam	Chayaver.
Kanarese	Chayaveru.

The plant is of no economic importance now and its cultivation has been abandoned.

DRYAGE OF STORED GRAINS.

It is impossible to give definite figures because conditions vary so widely. The following figures were obtained at Palur, and represent the loss in weight the crop underwent in the interval between the time it was harvested, and the time it was dry ready for sale :—

Paddy, 8—13 per cent.
Cumbu, 6—13 per cent.
Tenai, 11—17 per cent.
Groundnut *—Irrigated, 25—45 per cent.
Dry, 10—30 per cent.

* This probably includes loss of earth adhering to shell as well as moisture.

FOODS AND FEEDING.

COMPOSITION OF FOODS.

Name of food.	Water.	Proteid.	Oil or fat.	Carbo-hydrate.	Crude fibre	Ash.	Nutritive ratio.
GRAINS—CEREALS.							
Cholam	10·71	9·71	3·69	72·38	1·54	2·05	1 : 8·3
Oats	10·47	7·68	5·69	59 38	12 33	4·25	1 : 9·6
Ragi	11·29	9·44	4·93	60·13	6·56	7·65	1 : 7·5
Paddy	12·55	6·35	2·14	65·29	7·84	5·83	1 :11 0
Rice	12·25	6·45	·92	78·83	·21	1·33	1 :12·5
Varagu	8·84	8·04	4·57	65·20	7·39	5 95	1 : 9·5
Wheat	13·33	9·74	1·76	70·18	2·10	2·98	1 : 7·7
Maize	10·58	9·66	4·81	71 59	1·43	1·92	1 : 8·5
Kambu	8·77	9·52	5·33	73·52	·78	2·08	1 : 9·0
PULSES.							
Red Gram	10·13	17·56	1·34	61·36	5·78	3·78	1 : 3·7
Bengal Gram	9·98	18·14	4·39	57·94	6·40	3·15	1 : 3·7
Horse Gram	8·82	18·18	·80	62·29	4·13	5·76	1 : 3·5
Field Bean (Lablab)	9·59	21·35	1·25	57·23	6·57	4·01	1 : 2·8
Black Gram	9·69	22·81	1·13	59·36	3·27	3·74	1 : 2·7
Green Gram	10·38	21·22	1·07	59·58	3·80	4·12	1 : 2·9

Oil-seeds.							
Rape seed	6·69	18·29	39·46	23·18	5·24	7·13	...
Safflower	6·22	13·38	26·88	22·93	27·67	2·76	...
Cotton seed (naked from Bellary)	7·49	19·00	19·81	25·71	24·73	3·26	...
Cotton seed (fuzzy)	8·76	17·81	17·40	29·78	22·84	3·41	...
Linseed	5·80	17·91	40·31	26·12	5·27	4·53	1 : 6·6
Gingelly	4·73	19.32	49·13	15·28	4·21	7·32	...
Groundnut	4·70	29·09	49·25	13·21	1·65	2·20	1 : 4·3
Cakes or poonacs.							
Rape cake	...	31·6	9·6	29·3	11·0	...	1 : 1·6
Safflower	...	37·75	9·8	21 19	20·17	...	...
Cotton seed cake	..	23·5	6·6	32·0	21·1	...	1 : 2
Cotton seed cake (decorticated).	...	40·9	16·4	15·8	9·0	...	1 : 1·3
Linseed cake	9·20	29·3	7·0	32·7	...	...	...
Gingelly cake	10·00	38·0	...	...	...	9·7	...
Groundnut cake	9·91	52·06	7·99	20·68	4·63	4·73	...
Coconut cake	...	20·6	13·2	37·4	14·2	...	1 : 3 3
Fodders.							
Cholam (green)	69·52	1·36	·48	14 81	10·45	3·67	1 : 11·7
Cholam (straw)	8·70	2·10	1·50	39·67	39·79	8·24	...
Sunnhemp	14·39	11·31	1·12	35·85	27·39	9·94	1 : 3·5
Ragi (green)	80·83	1·94	·48	7·85	5·38	3·52	1 : 4·5
Ragi (straw)	14·16	1·94	·62	49·11	28·93	5·24	...
Paddy (straw)	11·04	2 70	1·02	40·84	29·23	15·17	...
Wheat (straw)	8·71	3·01	·98	37·93	35·69	13·93	1 : 1·3
Maize (green)	88·92	1·13	·31	4·65	3·11	1·88	1 : 4·7

COMPOSITION OF FOODS—*cont.*

Name of food.	Water.	Proteid.	Oil or fat.	Carbo-hydrate.	Crude fibre.	Ash.	Nutritive ratio.
Oat (straw)	12·85	3·83	1·07	51·47	25·23	5·42	...
Varugu (straw)	8·71	1·97	2·51	47·92	28·84	10·05	1 : 26·8
Kambu (straw)	7·07	1·94	1·33	43·99	37·63	8·04	1 : 23·5
Maize ensilage	81·87	·77	·21	9·44	5·50	2·21	...
Cholam ensilage	60·52	1·89	·65	21·37	11·29	4·28	...
Bean (straw)	...	9·9	1·5	31·8	33·5	...	1 : 3·6
Cow Pea (fresh)	...	1·9	·2	7·8	15·3	..	1 : 4·4
Red Gram (pods and leaves) ...	8 81	11·01	4·40	44·67	19·23	11·87	1 : 4·9
Bengal Gram (pods and leaves).	8 41	3 65	2·27	45·86	26·71	13·11	1 : 14
Lablab (pods and leaves) ...	9·92	13·37	3·72	43·03	16·17	13·78	1 : 3·8
Paddy husk (chittu)	8·58	3·85	2·54	34·75	29·24	21·03	1 : 10
Paddy bran (tavudu)	8·21	5·72	8·31	34·25	25·18	18·34	1 : 9·3
Green Gram (pods and leaves).	13·30	10·88	2·52	40·35	18·66	14·29	1 : 4·2
Wheat bran	11·84	13·20	3 50	58·42	8·42	4·97	...
Dried empty cotton bolls ...	14·23	9·72	1·77	34·08	...	...	...
MISCELLANEOUS.							
Cow's milk	86·33	3·32	4·83	4·60	...	·72	...
Buffalo's milk	82·22	4·34	8·09	4·56	.	·73	...

Composition of Rations.

A satisfactory ration must not only supply the necessary amount of nutrition but must also be sufficiently bulky to fill the animal's belly; it is not possible to keep an animal in health by feeding it only on concentrated food like groundnut cake or cotton seed, but it must also get a bulky fodder. It is important to see that the proportion between the nitrogenous (proteid) and the non-nitrogenous constituents is correct, in order on the one hand to avoid giving too much proteid which is expensive and wasteful, and on the other, diminishing the proteid below what is necessary for the animal's health whether it is a mature bullock or a growing calf. This proportion is called the nutritive ratio, and shows the proportion between the amounts of each *actually digested* by the animals. It is incorrect to work out the ration by the actual quantities found by analysis, though as a matter of fact it has to be done in many cases, because to find the digestive co-efficient, i.e., the proportion of a substance which is digested is a tedious business and necessitates actual trial on the animal. The nutritive ratio of a standard diet is worked out in both ways below. To find the nutritive or albuminoid ratio, the average percentages of the various substances are taken, the fat brought to its equivalent in carbo-hydrate by multiplying it by 2·29, and the total quantity of non-nitrogenous matter is then divided by the total quantity of nitrogenous matter.

For example, let us take the following ration :—1½ lb. cotton seed, 1½ lb. groundnut cake and 20 lb. cholam straw. Then :—

Food.	Quantity.	Albuminoids. Per cent.	Albuminoids. Amount.	Fats. Per cent.	Fats. Amount.	Carbohydrates. Per cent.	Carbohydrates. Amount.
	LB.		LB.		LB.		LB.
Cotton seed	1½	19·00	·28	19·8	·30	25·7	·39
Groundnut cake ...	1½	52·06	.78	7·99	·12	20·7	·31
Cholam straw ...	20	2·10	·42	1·50	·30	39·7	7·93
Total ...	...	...	1·48	...	·72	...	8·63

7·2 × 2·29 = 1·65. 1·65 + 8·63 = 10·28.

Albuminoid ratio = 10·28 ÷ 1·48 = 1 : 7.

If now we take the proportions which are actually digestible we get a somewhat different set of figures. The following digestive co-efficients may be assumed for ruminants :—

Food.	Albuminoids.	Fats.	Carbohydrates.
	PER CENT.	PER CENT.	PER CENT.
Cotton seed	67	87	49
Groundnut cake	70	89	49
Cholam straw	46	74	74

The percentages of the constituents will thus be—

Food.	Albuminoids.	Fats.	Carbohydrates.
Cotton seed...	12·88	17·25	12·75
Groundnut cake	36·75	7·17	10·15
Cholam straw	0·98	1·11	29·59

and the correct nutritive ratio will be—

Food.	Albuminoids.		Fats.		Carbohydrates.	
	Per cent.	Lb.	Per cent.	Lb.	Per cent.	Lb.
Cotton seed, 1½ lb.	12·88	·19	17·25	·26	12·75	·19
Groundnut cake, 1½ lb.	36·75	·55	7·17	·11	10·15	·15
Cholam straw, 20 lb.	0·98	·20	1·11	·22	29·59	5·92
Total ..	...	·94	...	·59	...	6·26

·59 × 2·29 = 1·35. 1·35 + 6·26 = 7·61.
Albuminoid ratio 7·61 ÷ ·94 = 1 : 8.

Specimen rations.

Bullocks doing hard work.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Horse Gram, 2 lb....	0·27	0·008	1·00
Cotton seed, 3 lb.	0·39	0·52	0·38
Paddy straw, 25 lb.	0·30	0·12	3·27
Total ...	0·96	0·74	4·65

0·74 × 2·29 = 1·69. 1·69 + 4·65 = 6·34.
Albuminoid ratio = 6·34 ÷ 0·96 = 1 : 6·6.

Safflower cake, 3 lb.	0·96	0·26	0·51
Cholam straw, 15 lb.	0·15	0·17	4·44
Total ...	1·11	0·43	4·95

0·43 × 2·29 = ·98. ·98 + 4·95 = 5·93.
Albuminoid ratio = 5·93 ÷ 1·11 = 1 : 5·4.

Cotton seed, 4 lb.	0·52	0·69	0·51
Italian millet straw, 20 lb. ...	0·15	0·09	3·89
Total ...	0·67	0·78	4·40

0·78 × 2·29 = 1·83. 1·83 + 4·40 = 6·23.
Albuminoid ratio = 6·23 ÷ 0·67 = 1 : ·93.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Horse Gram, 4½ lb.	·63	·02	2·25
Paddy husk (chittu), 7 lb. ...	·27	·17	2 43
Paddy bran (tavudu), 3½ lb. ...	·20	·29	1·19
Total ...	1·10	·49	6·42

0·49×2·29=1·12. 1·12+6·42=7·54.
Albuminoid ratio=7·54÷1·09=1 : 6·8.

Cows in milk.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Groundnut cake, 2 lb.	0·74	0·14	0·20
Green fodder, 70 lb.	0·45	0·25	7·67
Total ...	1·19	0·39	7·87

0·39×2·29=0·89. 0·89.×7·87=8·76
Albuminoid ratio 8 76÷1·19=1 : 7·36.

Cotton seed, 1 lb.	0 13	0·17	0·13
Grass, say, 70 lb.	0·56	0 20	5·03
Total ...	0 69	0 37	5·16

0·37×29=0·85. 0·85+5·16=6 01.
Albuminoid ratio=6·01÷0.69=1 : 8·71.

Dry cows.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Grass, say, 50 lb	0·40	0·14	3·60

0·14×2·29=0·32. 0·32+3·60=3·92.
Albuminoid ratio=0·40÷3·92=1 : 9·8.

Cholam straw, 20 lb.	0·20	0·22	5·92

0·22×2·29=0 50. 0·50+5·92=6·42.
Albuminoid ratio =6·42÷0·20=1 : 32·1.

Calves.

Food and amount.	Albuminoids.	Fats.	Carbohydrates.
Groundnut cake, ½ lb	0 06	0·09	0·06
Cholam, green, 10 lb.	0·64	0·04	1·10
Milk, ½ measure, 2 lb. (cow's) ...	0 06	0·10	0·09
Total ...	0·76	0·23	1·25

0·23×2 29=0·53. 0·53+1·25=1·78.
Albuminoid ratio=1 78÷76=1 : 2·3.

Milk (cow's), 1¼ Madras measures 5 lb.	0·16	0·24	0·23

0·24×2·29=0·55· 0 55+0·23=0·78.
Albuminoid ratio= ·78÷·16=1 : 4·9.

Milk (buffalo's), 1½ Madras measures, 6 lb.	0·27	0 49	0 27

0·49×2·29=1·12. 1·12+0·27=1·39.
Albuminoid ratio=1·39=0·27=1 : 5·1.

DIGESTIVE CO-EFFICIENTS.

Food and amount	Albuminoids.	Fats.	Carbohydrates.
Horse Gram	75	59	80
Paddy straw	45	47	32
Safflower cake	85	88	80
Italian millet (tenai) straw ...	25	42	54
Green fodder (cholam)	46	74	74
Grass	58	58	48
Milk	94	100	98

NOTE.—The digestive co-efficients in these illustrations are those which have been worked out for similar foods in other countries. The actual figures may vary very largely from these.

COST OF FEEDING A PAIR OF CATTLE PER ANNUM.

Saidapet, 1885.

	RS.	A.	P.
Fodder, 100 lb. a day at 400 lb. the rupee ...	91	4	0
Cake, 8 lb. a day at Rs. 7 a candy of 500 lb. ...	40	14	0
Interest on value of cattle at 5 per cent on Rs. 100	5	0	0
Depreciation at 10 per cent per annum	10	0	0
Shoeing twelve times a year at 12 annas ...	9	0	0
Contingencies	3	14	0
Total ...	160	0	0

Coimbatore, 1911.

Cholam straw—January, February and March 90 days—30 lb. a day; 2,700 lb. at 250 lb. a rupee	10	12	10
Tenai straw; April 30 days—30 lb a day; 900 lb. at 150 lb. a rupee	6	0	0
Wheat straw and gram pottu; May 31 days—30 lb. a day; 930 lb. at 500 lb. a rupee	1	13	9

	RS.	A.	P.
10 lb. of green fodder a day additional in May, 3,100 lb. at 300 lb. a rupee	1	0	6
Paddy straw—June, July and August, 122 days—30 lb. a day, 3,660 lb. at 150 lb. a rupee.	24	6	5
Ragi straw, October 31 days, 80 lb [green] a day, 2,480 lb. at 400 lb. a rupee	6	3	2
November, 30 days, 40 lb. [dry] a day, 1,200 lb. at 250 lb. a rupee	4	12	9
Grass —December 31 days, at 100 lb. a day, 3,100 lb. at 500 lb. a rupee	6	3	2
Groundnut cake 365×3 1,095 lb. at Rupees 78-12-0 a ton	38	7	11
Cotton seed 365×3 1,095 lb. at Rs. 95 per ton	46	7	0
Salt 365×2 tolas or $\frac{730\times2}{5\times16}$ lb. or $18\frac{1}{4}$ lb. at 6 pies a lb.	0	9	2
Shoeing four times at 12 annas	3	0	0
Interest at 5 per cent on Rs. 200	10	0	0
Depreciation at 10 per cent on Rs. 230	20	0	0
Attendance	12	0	0
Contingencies	3	3	4
Total ...	195	0	0

COST OF FEEDING COWS PER ANNUM.

Saidapet, 1885.

	RS.	A.	P.
11,000 lb. of green food	36	12	0
1,500 lb. oil cake	21	0	0
730 lb. wheat barn	18	4	0
730 „ dholl husk	11	6	0
20 lb salt	0	10	0
Attendance and sundries	18	0	0
Interest on value of cow Rs. 150, at 5 per cent and depreciation at 10 per cent	22	8	0
Total ...	128	8	0
Deduct.—One-third value of artificial food chargeable to manure	16	8	0
Net cost per annum ...	112	0	0

Coimbatore.

(In milk 10 months, 304 days.)

	RS.	A.	P.
Cotton seed, 1 lb. a day, 304 lb. at Rs. 95 a ton	12	14	3
Groundnut cake, 1 lb. a day, 304 lb. at Rupees 78–12–0 a ton	10	11	0
Dholl husk, 2 lb. a day, 608 lb. at Rs. 1–3–0 for 50 lb.	14	7	0
Green cholam fodder, 40 lb. a day, 9,680 lb. for 242 days at 300 lb. a rupee	32	4	3
Green grass, 60 lb. a day, 3,720 lb. for 62 days at 500 lb. a rupee	7	7	0
Salt, 1 tola a day, 304 tolas for 304 days or 7½ lb. at 6 pies a lb.	0	3	8
Total ...	77	15	2

(Dry two months.)

	RS.	A.	P.
Dry cholam fodder (straw) 20 lb. a day, 1,220 lb. for 61 days at 250 lb. a rupee	4	14	2
	82	13	4
Attendance*	18	0	0
Depreciation at 10 per cent per annum on Rs. 80.	8	0	0
Interest at 5 per cent on Rs. 80	4	0	0
Contingencies	1	11	8
Total	114	9	0
Deduct—One-fourth value of artificial food chargeable to manure	9	9	0
Net cost per annum ...	105	0	0

COST OF FEEDING CALVES.

First year.

	RS.	A.	P.
Milk for the first two months, 30 Madras measures at 4 annas a Madras measure ...	7	8	0
Groundnut cake, ¼ lb. a day for 10 months, 76 lb. at Rs. 78-10-0 per ton	2	10	9

* One man on Rs. 8 and one boy on Rs. 4 a month of every eight cows.

	RS.	A.	P.
Cotton seed, ¼ lb. a day, for 10 months, 76 lb. at Rs. 95 per ton	3	3	7
Dholl husk, ¼ lb. a day, for 10 months, 76 lb. at Rs. 1-3-0 for 50 lb.	1	12	11
Salt	0	0	10
Fodder similar to that of cows, at one-fourth their rate	8	0	0
Attendance *	2	0	0
Total ...	25	4	1
Second year.			
Groundnut cake, ½ lb. a day, 182½ lb. at Rupees 78-12-0 per ton	6	6	8
Cotton seed, ½ lb. a day, 182½ lb. at Rs. 95 per ton.	7	11	10
Dholl husk, ½ lb. a day, 182½ lb. at Rs. 1-3-0 for 50 lb.	4	5	4
Salt	0	1	0
Fodder, similar to that of cows, at half their rate	20	0	0
Attendance	2	0	0
Total ...	40	8	10
Third year.			
Groundnut cake, ¾ lb. a day, 274 lb. at Rupees 78-12-0 per ton	9	10	0
Cotton seed, ¾ lb. a day, 274 lb. at Rs. 95 per ton	11	9	9
Dholl husk, ¾ lb. a day, 274 lb. at Rs. 1-3-0 for 50 lb.	6	8	0
Salt	0	1	0
Fodder, similar to that of cows at half their rate	20	0	0
Attendance	2	0	0
Total ...	49	12	9
Total for three years	115	9	8
Contingencies for three years	4	6	4
Grand total ...	120	0	0

* This has been calculated at the rate of Rs. 4 (one boy) for every 24 calves per month all through.

Rations.

(Fed to calves at the Military Dairy Farm, Bangalore.)

First period—birth to 21 days ...	6 lb. whole milk given three times a day.
Second period—third to fifth week.	Whole milk ... 1 lb. Separated milk. 5 „ Barley meal ... 1 „ Linseed oil ... 1 oz.
Third period—sixth week to third month.	Separated milk. 2 lb. Barley meal ... 4 „ Linseed oil .. 1 oz.
Fourth period—fourth to fifth month.	Barley meal raised to 6 lb.
Fifth period—sixth to eighth month.	Barley meal gradually reduced until none is given. Green fodder is now given and a ration of 1 lb. wheat bran; $\frac{1}{4}$ lb. oil cake and $\frac{1}{4}$ oz. salt each day.

From ninth month on the normal young stock ration is fed, viz.:—

Wheat bran	1 lb.
Decorticated cotton cake	1 „
Green fodder	15 „

or

Second period—third week to sixth month.	Whole milk ... 1 lb. Separated milk. 5 „ Cotton seed meal. 1 „ Fodder as much as they will eat.
Fourth period—sixth to eighth month.	Cotton seed meal. 1 lb. Hay ... ... 15 „ Salt ... ... 2 oz.
From ninth month	Cotton seed meal. 2 lb. Cotton seed hulls. 1 „ Rice bran ... 1 „ Salt ... ... 2 oz. Hay ... ...15 lb.

Pasturage fees.

In the northern deltas, Rs. 20 to Rs. 30 are charged for grazing a pair of bullocks for four months—August to September—including watching charges.

LIVE-STOCK.

NAMES OF CATTLE.

Male.

At birth.—Bull calf ; if castrated, bullock calf or stot calf.

When a year old.—Yearling bull or year-old bull ; if castrated, year-old stot or steer.

When two years old.—Two-year old bull ; if castrated, two-year old stot or steer.

When three years old and upwards.—Three-year old bull or bullock (if castrated), four-year old bull or bullock, five-year old bull or bullock, aged bull or bullock ; or

Two-teeth bull or bullock, four-teeth bull or bullock, six-teeth bull or bullock, full mouthed bull or bullock, aged bull or bullock.

Female.

At birth.—Heifer calf or cow calf.

When a year old.—Yearling heifer or year-old heifer.

When two years old.—Two-year old heifer.

When three years old.—Three-year old heifer.

A cow or heifer that has received the bull is said to have been served or bulled and, if in calf, is called cow in calf or heifer in calf.

A heifer becomes a cow on bearing a calf.

A cow in milk is termed a milk or milch cow (Tamil *Karavai*). When she ceases milking, she is a dry or yeld cow (Tamil *Varadu*).

Cows, as a rule, bear one calf at a time. If two are born at one birth, they are termed twins, if three, triplets. When a bull and heifer calf are born twins, the latter is called a free martin and is usually barren.

BREEDING.

Cattle are bred in India for draught and milk purposes. Draught cattle are used for the plough, the mhote and the cart. Bullocks are also used as beasts of burden. Of the several breeds in Southern India, the pre-eminent and the best defined ones are the Ongole and the Mysore. The Ongoles are huge in size and are suitable for a steady, heavy draught. The cows on an average give 6 to 10 lb. of milk

per day. The best ones may yield as much as 15 to 20 lb. in 24 hours. The Mysore cattle are quick of pace and very spirited and are specially suited for road work. The cows are poor milkers. Between these two extremes are all the remaining several breeds, in which the working and milking capabilities are combined and are of a medium standard. Indian heifers, as a rule, do not come in heat until they are from 3½ to 4 years old, but some take the bull as soon as they have cut the first pair of teeth, that is, when they are 2½ years old, and instances are known in which heifers have produced their first calves before cutting the first pair of teeth. It is quite safe to breed from heifers which have cut the first pair, and it is desirable from the point of view of saving in the matter of keep, that they should be so bred from. Early maturity can be secured by proper feeding and care. Indian cattle tend to go dry for a long time. They are not fed when they are dry and it does not pay the owner to do so. There is no reason why cows, when they are dry, should not be used as draught animals until they are within a month and a half or two of calving and fed and looked after well. This practice obtains in some parts of Coimbatore and Salem districts, and deserves further extension. A cow comes in season, as a rule, every three weeks, but this varies very much with different animals. A good cow should average a calf a year; this means she should take the bull two to four months after calving. A cow after calving should not be given the bull, even if she comes in heat, until two months have elapsed since calving. Some cows may go on milking during the whole period of pregnancy. In such cases they should be dried when they are within a couple of months of calving, so that the mammary glands may have rest and the process of the secretion of new milk may go on undisturbed. Heifers should not be allowed to get too fat, as oestrum is liable to be delayed, and they may even go barren. The breeding bull should be particularly selected as his influence on the progeny is extensive, and as he becomes the sire of many animals. A bull should not be used for breeding before he has at least cut the first pair, that is about 2½ years old. He is in his vigour from the third to the eighth year, after which he should be discarded. He must be fed well, and light and regular work will keep him in good condition, health and spirit. The average period of gestation in cows is 9½ months or 285 days. It is said that they go longer with a bull calf than with a heifer, which is, however, not confirmed by observation. The signs of pregnancy in a cow are these. She does not

come in heat again, and there is improvement in her condition. The abdomen enlarges and becomes pendulous, particularly on the right side. The udder increases in size, and the mucous discharge from the genital parts is also increased. After the fifth month, fœtal movements can be perceived by looking at the flank on the right side. Abortion or miscarriage occurs occasionally. It is due to the nature of the food and other influences. Pregnant animals when affected with blood diseases may abort. Abortion is also caused by certain bacterial organisms, and therefore rigid separation of animals which have aborted from those which are pregnant should be attended to. Approaching parturition is indicated by the swelling of the udder and occurrence of milk in it, discharge of thick mucus from the vulva, and the loosening or 'slipping' of the hinder parts, due to the relaxation of the pelvic ligaments. The process of parturition occupies about an hour. The placenta or after-birth comes away in ½ to 4 hours after the calf has been dropped.

Rearing.

The calf is allowed to suck its mother both before and after milking. In some parts the calf is tied to the arm of the mother and is allowed to suck only after milking. In Europe the general practice is to separate the calf from the dam as soon as it is born, or in a week or ten days after birth and to hand-feed it. Both the systems have their advantages and disadvantages. Allowing the calf access to the mother acts as a stimulus for the secretion of milk and ensures the udder being thoroughly emptied after each milking, and the cow yields her milk freely. When the cow is out grazing, there is no danger of her milk being drawn stealthily. The disadvantages are that the cow may not give milk if the calf dies, and that it is difficult to regulate the amount of milk to be left for the calf. Under the European system, the calf is given a regulated and required amount of milk, and the cow can be milked whether the calf is alive or dead, but there is no certainty of the milkman stripping the udder thoroughly. As soon as cow has calved, she should be milked and a portion of the milk should be given to the calf or left in the udder for it to suck. The milk yielded for the first four or five days is called *colostrum*; it contains a high proportion of albumen and curdles when boiled. It is called in Tamil '*seempal*', that is, '*pus milk*'. This milk contains some laxative principle and helps to clear the intestines of the calf of *meconium*. Some cows do not secrete milk on the very first day

of calving. In such a case an ounce or two of castor oil may be given to the calf.

The calf should be fed for the first three weeks on 4—5 lb. of milk per day in 3 or equal quantities. After 18 days, milk can be increased gradually up to 8 lb. per day up 3 months of age. After three months, new milk can be reduced and separated milk substituted so that the ration will be 6 lb. new milk and 3 lb. separated milk and after the fourth month, 3 lb. whole milk and 6 lb. separated milk or more if it can be spared. This substitution should be done gradually each week so that, at about 4½ months the calf is getting about 10 lb. separated milk per day.

After the first month or six weeks the calf can be given a little scalded wheat bran (fed lukewarm) and some hay or grass to pick at.

After three months, it can be given ½ lb. groundnut-cake and ¾ lb. of wheat bran or rice bran soaked in water.

This ration can be increased gradually up to 6 months.

If the calf is well grown at 6 months and milk stopped ration can be increased to

1½ lb. wheat or rice bran ¾ lb. groundnut-cake ½ lb. cotton seed	To be fed twice per day morning and evening.

Green grass, hay or straw should also be fed daily.

Feeding of calves should be done at regular hours. If fed at irregular intervals, the calves' digestion might be affected. Milk should be fed at body temperature. If fed cold or too hot, the calf will probably suffer from diarrhœa (white scours). For the first three weeks the calf should be fed 3 times per day, say at 6 a.m., 12 noon and 6 p.m.

Calves should be stalled in good clean sheds with a flag or concrete floor and if possible an open yard for exercise should be provided.

A little salt say ¼ oz. per day should be fed in the concentrated ration.

Bulls are castrated in this country when they are four and five years old, the objection to earlier castration being that the growth is stunted. Unfortunately this leads to promiscuous breeding, young and unsuitable stock being allowed to cover cows. It is still a matter for question, as to the best age at which to castrate young bulls, so far as their growth and nature is concerned. Young animals should get exercise. Even when there is no grazing available, they must be taken out for a run. The weight of calf at birth is 1/15 to 1/12 of that of the mother. Nellore calves weigh 40 to 50 lb. at birth and kangayam and big-sized country calves 30 to 40 lb.

FEEDING.

After a calf has been weaned, it must be fed liberally and regularly as the animal goes on continuously growing. It is only a well-fed calf that will grow into a good bull or heifer. Bad or interrupted feeding during the early years tells upon the system throughout life. In addition to good grazing or supply of fodder and grass, which forms the bulk of food in cattle of all ages, the young stock should get a certain amount of concentrated food. The tissues of the body among other elements contain nitrogen. Nitrogen is not contained in all food stuffs but the other elements generally are. The special food given to young stock should therefore be rich in nitrogen. Nitrogen is found in cotton seed and in pulses such as grams, groundnuts, etc. A mixture of equal parts of horse-gram, cotton-seed and groundnut cake will be a proper food for young stock. Young animals should be let loose daily for grazing and exercise. Ryots take care of their bull calves but neglect their heifer calves. It is very right to feed and look after the bull calves well, so that they may grow into good breeding bulls or draught cattle, but it is wrong to neglect the heifer calves. If heifers are required for breeding they must be brought up well. Both the sire and the dam influence the progeny, although the former has more influence in the herd. A dairy cow in milk must be fed well and regularly. She must get some green fodder or grass and also some nitrogenous and fatty food stuffs, such as oil-cakes and cotton seed. Bulls and working cattle should, in addition to fodder and straw, get some special food. Common salt is as necessary to cattle as it is to man, and a tola or two per head should be given daily mixed with food. Proper housing must be provided. and cattle must be protected from exposure and wind during inclement weather.

Heifers and young bulls (6 months 2 years.)

These animals should be well fed so that they keep on growing, if properly fed from birth, they will come to maturity quicker and will bring profit in a shorter time than if they are only half fed.

A suitable ration which can be fed to them is as follows :—

8—12 months—

- 1½ lb. rice bran.
- 1½ lb. gingelly or groundnut-cake.
- 1 lb. cotton seed or dholl husk.
- 12 lb. cholam straw or 15 lb. paddy straw.
- 20 lb. green grass.

1—2 years—

2 lb. rice bran, or	2 lb. rice bran.
2 ,, cake	1½ ,, cake.
1½ ,, cotton seed.	1 ,, cotton seed..
15 ,, cholam straw, or	1 ,, dholl husk.
20 ,, paddy straw.	15 ,, cholam straw
	20 ,, paddy straw.or

Dry cows.

These animals should receive some concentrated food and not be fed on straw only as is the custom.

A suitable ration is—

½ lb. rice bran.	10 – 15 lb straw.
1 ,, cake.	

This should be increased a month before the cow calves to—

2 lb. rice bran.	½ lb. cotton seed.
2 ,, cake	

Cows in milk should be fed according to the yield of milk. A cow requires at least 3—4 lb. of concentrated food daily in order to replace waste tissue, energy expended, etc. Then, for each gallon or 10 lb milk she yields she should receive from 3 to 4 lb. of concentrated food. The following are some suggestions for rations :—

Cows giving 10 lb. Milk—

Rice bran	... 3 lb.	or	Rice bran	... 3 lb.
Cake ...	... 2 ,,		Cake ...	... 2 ,,
Cotton seed	... 3 ,,		Cotton seed	... 1½ ,,
Straw ...	12 to 15 ,,		Dholl husk	... 1½ ,,
			Straw ...	12 to 15 ,,

Cake can be substituted by horse gram meal or cholam or ragi meal.

Cows giving 15 lb. Milk—

Rice bran	... 3½ lb.	or	Rice bran	... 4 lb.
Cake ...	... 3 ,,		Cake ...	... 3 ,,
Cotton seed	... 2½ ,,		Dholl husk	... 2 ,,
Dholl husk	1 ,,		Straw ...	12 to 15 ,,
Straw ...	12 to 15 ,,			

Work Bullocks—

These animals should receive a liberal ration if they are doing hard work daily :—

Cake ...	... 2 lb.	or	Horsegram	... 2 lb.
Cotton seed	... 1½ ,,		Cotton seed	... 1½ ,,
Rice bran	... 2 ,,		Rice bran	... 5 ,,
Straw ...	.. 15 ,,		Straw ...	... 15 ,,
	per day.			per day.

Work bullocks doing light work—

Cake	1½ lb.		or	Cake	2 lb.
Cotton seed ...	2 „			Cotton seed ...	1 „
Bran	1 „			Bran	2 „
Straw ...	10 to 15 „			Straw ...	10 to 15 „

¼ oz. of salt should be given daily mixed in the ration of each animal.

Age of Cattle.

The age of cattle is estimated by means of the teeth and also by the rings or nicks round the horn. The first ring appears at the third year, and then each year is supposed to add a ring, so that if there are two rings, the animal is considered four years old, if three rings, five years old and so on. The rings are, however, not always well marked, and it is much safer to judge the age by the teeth.

Dentition.—The dentition of cattle is typical of the ruminants. At or within a month after birth the calf has eight incisors, or six incisors and two canines, in the lower jaw (the canines are shaped exactly like the incisors and situated close to them and are generally regarded as incisors) and twelve premolars, three on each side above and below. The upper jaw has no incisors nor canines and is provided instead with a cartilaginous pad (dental-pad). All these are temporary or milk-teeth, and they are replaced later by permanent ones. Three molars on each side of each jaw behind the premolars come up and complete the permanent dentition. The number of permanent teeth is thus 32. Until the eight permanent incisors are completed when the animal is said to be full-mouthed, the age can be told with correctness. After this, ageing is a matter of guess work from the extent to which the teeth are worn.

Dental formula for milk teeth—

$$\text{Incisors}\ \frac{0-0}{4-4},\ \text{premolars}\ \frac{3-3}{3-3},\quad \text{Total 20.}$$

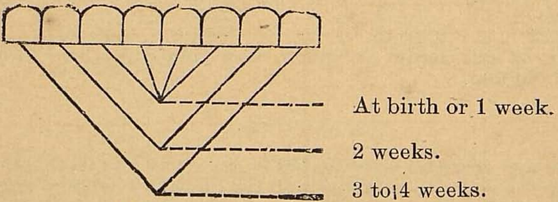
Dental formula for permanent teeth—

$$\text{Incisors}\ \frac{0-0}{4-4},\ \text{premolars}\ \frac{3-3}{3-3},\ \text{molars}\ \frac{3-3}{3-3}.\quad \text{Total 32.}$$

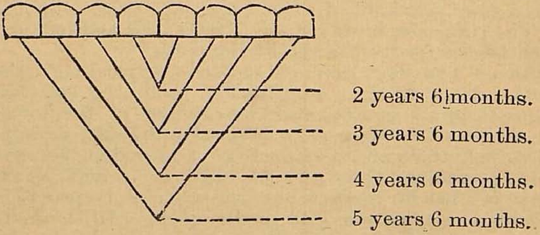
The top figures show the teeth on each side of the upper aw and the bottom figures the teeth on each side of the lower jaw.

Teeth indicating age—

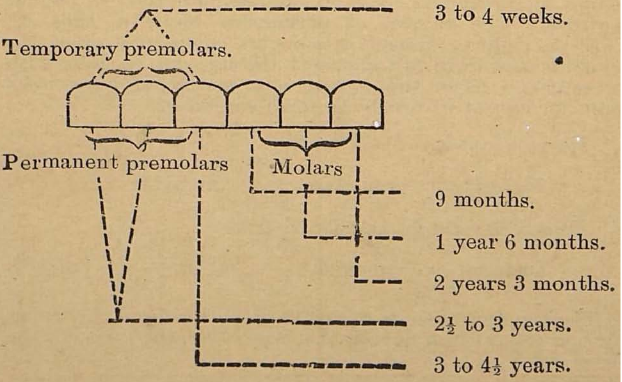
(Appearance of temporary incisors.)



(Appearance of permanent incisors.)



(Appearance of molars.)



CALVING TABLE.

Average period of gestation, 285 days.

If served on	Will calve about	If served on	Will calve about
January 1	October 13	July 1	April 12
„ 7	„ 19	„ 7	„ 18
„ 14	„ 26	„ 14	„ 25
„ 21	November 2	„ 21	May 2
„ 28	„ 9	„ 28	„ 9
„ 31	„ 12	„ 31	„ 12
February 1	„ 13	August 1	„ 13
„ 7	„ 19	„ 7	„ 16
„ 14	„ 26	„ 14	„ 26
„ 21	December 3	„ 21	June 2
„ 28	„ 10	„ 28	„ 9
March 1	„ 11	„ 31	„ 12
„ 7	„ 17	September 1	„ 13
„ 14	„ 24	„ 7	„ 19
„ 21	„ 31	„ 14	„ 26
„ 28	January 7	„ 21	July 3
„ 31	„ 10	„ 28	„ 10
April 1	„ 11	„ 30	„ 12
„ 7	„ 17	October 1	„ 13
„ 14	„ 24	„ 7	„ 19
„ 21	„ 31	„ 14	„ 26
„ 28	February 7	„ 21	August 2
„ 30	„ 9	„ 28	„ 9
May 1	„ 10	„ 31	„ 12
„ 7	„ 16	November 1	„ 13
„ 14	„ 23	„ 7	„ 19
„ 21	March 2	„ 14	„ 26
„ 28	„ 9	„ 21	September 2
„ 31	„ 12	„ 28	„ 9
June 1	„ 13	„ 30	„ 11
„ 7	„ 19	December 1	„ 12
„ 14	„ 26	„ 7	„ 18
„ 21	April 2	„ 14	„ 25
„ 28	„ 9	„ 21	October 2
„ 30	„ 11	„ 28	„ 9

Common diseases.

Simple fever.—This may be brought about through changes of weather, change of food, or exposure. It is ushered in with a shivering fit, which is followed by hurried breathing and with temperature increased to 104° to 106°. Confine the animal to the stall. Give as drench 8 to 12 ounces of Epsom salts with an ounce of nitre. Then give twice a day an ounce of common salt and two drams of nitre in a pint of water. The patient must have green grass and plenty of pure drinking water. When free from the complaint an ounce of powdered chirata with two drams of black pepper in a pint of water or gruel may be given once daily for a few days.

Rheumatism.—A common complaint in India. It results from the inflammation of the fibrous tissue through exposure to wet and damp. It is most common in the south-west monsoon—June to September. Young animals between the ages of one and five are most liable. There is high fever attended with stiffness and pain in moving. The animal walks very lame. It soon lies down and is unable to get up. The attack lasts for about three days, when fever and lameness disappear, but stiffness in gait remains for some time. Give at once a pound of Epsom salts with half an ounce of ginger in sufficient quantity of warm water. The animal must be provided with a good bed and have placed before it green grass and pure fresh water with a little nitre dissolved in it. After recovery two ounces of sulphur may be given once daily for a few days.

Cancer.—Cancerous tumours and sores are not uncommon in cattle. The only plan is to remove the diseased part completely by surgical means. If this is not possible, the disease cannot be eradicated. Mild caustics may be used as a palliative measure.

Tuberculosis.—This is what is commonly known as consumption in man. It attacks cattle and other domesticated animals. The disease is infectious. The cause is an organism known as *Bacillus tuberculosis.* It is a blood disease, but the organs particularly affected are different in different attacks. The lungs are the organs most frequently attacked, but the liver and intestines and other abdominal organs may also be the seat of the disease. Joints are sometimes affected. The affected animal is out of condition and falls away in flesh. The fæces are offensive and loose. When the lungs are affected there is also a cough, which is week and coarse. *Post-mortem* examination shows the presence of small nodules or tubercles in the organs affected. There is no known cure

for the disease. Young animals and cows five to eight years old are most liable. Infected animals must be removed from the herd. They are unsafe to use either for breeding, milking or for human food.

Pleuro-pneumonia contagiosa.—Inflammation of the lungs and pleura may be simple or contagious. The latter is a specific form and is contagious and infectious. It is fortunately rare in India. There is fever and general signs of disease. The breathing is hurried, the muzzle is protruded and the patient grunts and moans during respiration. Pressure between the ribs makes the animal grunt from pain. Purging sets in and the animal dies eventually of suffocation and exhaustion. Affected animals must be isolated. Ten drops of carbolic acid may be given twice daily in rice gruel. Turpentine must be well rubbed in on the throat and chest. The disease is almost always a fatal one and it is best to destroy the animal in the early stage.

Foot-and-mouth disease.—A highly infectious and contagious disorder attacking cattle principally, but also transmissible to sheep, goats and buffaloes. The period of incubation varies from one to four days, and the disease shows itself with an elevation of temperature from two to five degrees. The disease is characterized by the appearance of vesicles or blisters in the mouth and between the toes and, in cows, on the udder also. The blisters soon burst leaving raw sores. There is saliva foaming from the mouth, with a peculiar smacking of the lips and tongue. The feet are so sore that the animal is extremely lame, and moves with great difficulty. Mortality is very rare in adult animals, but the disease may prove fatal to very young calves. The diet must be nutritious and soft, such as rice or other grain, gruel and green grass. Give a mild purgative at the commencement. Wash the mouth once daily for two or three days with alum lotion—20 to 30 grains to an ounce of water. The feet must be kept clean and dressed with carbolic, camphor or margosa oil. If the udder is affected, treat as in *mammitis*. The milk of the affected animals should not be used without being well boiled.

Rinderpest.—This is the most formidable disease in cattle and is highly infectious and contagious. It also attacks sheep, goats and buffaloes. In virulent outbreaks, mortality is 80 to 90 per cent, in ordinary 40 to 50 per cent. The period of incubation lasts from four to eight days but may extend even to 14 days. In the beginning there are all the general signs of disease. There is fever, persistent shivering, congestion of the mucous membranes of the mouth, nose, eyes and vagina,

followed with a discharge of acrid tears from the eyes, and of copious saliva from the mouth, and a muco-purulent discharge from the nose and the vagina. There are often sores in the mouth. Bowels are at first constipated, but soon fetid diarrhœa of a dirty yellow colour with mucus and blood in it sets in. The prostration of strength is very great. In milch cows the secretion of milk entirely ceases. Duration of the disease is from 2 to 10 days. As a rule, a crisis sets in about the sixth or seventh day and the animal dies or shows signs of recovery. Treatment: at the commencement, when the bowels are costive, give once daily, until the bowels get loose, 8 to 10 ounces of castor or linseed oil. Twenty to thirty minims of carbolic acid may be administered in a pint of warm gruel once daily. If there be bloody diarrhœa, give some astringent (see Recipes). Diet must consist of fresh young grass and of gruel, which must be gently drenched down if the animal will not take it of its own accord. Affected animals should be strictly isolated. The carcases with the dung, litter, etc., should be burned or buried deep with quicklime.

Cow-pox.—A specific eruptive fever in cattle. It is of rare occurrence. Cows are more liable to it than bulls, and cows after calving are most liable. It is not a severe affection. The eruptions show themselves in the region of the udder, and teats in the form of circular vesicles with a central depression. The vesicles contain a clear fluid termed lymph, which gradually becomes opaque and purulent. In the course of a few days the pustules burst and scales form, which soon drop away. The disease terminates in about three weeks and calls for no special treatment. If the udder is much inflamed, foment with hot water twice daily, and after milking, dust a little powdered chalk or alum over the sores. Isolation is seldom necessary. Milk of the affected animals must be rejected. It is with the lymph contained in the vesicles of cow-pox that man is vaccinated as a protection from small-pox. One attack of cow-pox gives the animal immunity from the disease in future.

Hæmorrhagic septicæmia.—This term includes a variety of diseases, Buffalo disease, Deer disease, Gloss-Anthrax, Swine plague, Fowl cholera, Contagious Pneumonia of the horse, etc. The agent that produces this disease is a cocco-bacillus or Pasteurella. In cattle it is found in three forms mostly commencing to attack buffaloes (hence the name). They are as follows :—

i. Exanthematic.
ii. Lung form.
iii. Intestinal form.

The first form of this malady is characterized by its rapidity of onset and course and its fatal termination. The animal is off feed, rumination suspended, temperature rising very high as 108° to 109° F. There is hurried breathing with great distress, and often a bloody discharge from the nostrils and bowels. Large swellings of a tense nature appear at the throat, in the dewlap and sometimes over the fetlocks and shoulder. In some cases the throat swelling is so great that the animal is totally unable to breathe or swallow. The tongue swells up very much and hangs out. The mouth is frothy, the visible mucous membranes are purple coloured, and death often occurs in a few hours. In the other two forms the lungs and digestive organs are chiefly affected, the animal having an acute pneumonia and pleurisy in the lung form and inflammation of the alimentary canal in the third form.

The disease often occurs in an area as an outbreak and is worst on marshy low-lying pastures and badly drained and ill-ventilated sheds.

Treatment is not of much avail. Preventive measures to be adopted are segregating the sick animals, and removing from unhealthy surroundings. Treat sick animals with a dram of carbolic acid in a pint of linseed or castor oil internally or soda hyposulphate 1 oz. morning and evening in drinking water. Tincture of iodine, liniments and fomentations may be applied to the swellings. Healthy animals may be protected by subcutaneons injection of anti-Hæmorrhagic Septicæmic serum.

This disease can be differentiated from Rinderpest by the absence of mouth lesions and sudden onset of symptoms. The carcases of animals affected with this disease have to be disposed of in the same way as Anthrax and disinfection carried out the same manner.

Anthrax.—This is a specific contagious disease attacking cattle and other domestic animals. It is caused by the presence of an organism in the blood called *Bacillus anthracis*. The disease is highly fatal (95—99 per cent) and runs a rapid course from a few hours to a few days. It is communicable to man. It appears mostly in two forms.

Splenic form.—This form is called splenic fever and is characterized by a very high fever, discharge of bloody fæces and high coloured urine, and tympany; death ensues in a few hours. In many instances animals seen apparently in good health a few hours before are found dead suddenly. On *post-mortem* examination the spleen is found considerably enlarged, and distended with tarsy blood.

Enteric form.—All the above mentioned symptoms are noticed and in addition there is severe colic and dark coloured blood escapes with the fæces from the bowels. Here also death occurs within a few hours.

Treatment is not of much avail. The animal should at once be isolated and the whole place thoroughly disinfected. A dram of carbolic acid in a pint of linseed oil may be given at once. The carcases of animals that have died of this disease should either be burned or buried deep with quick-lime. They should be covered with straw to prevent discharges falling to the ground from the natural openings and then removed to the burial or burning ground. The earth in the sheds for about six inches must be dug and replaced with fresh earth and quicklime, and the whole place thoroughly disinfected with strong antiseptic lotions, after burning a layer of straw on the floor. Temporary isolation sheds are better burned after an outbreak. Thorough scrubbing of the walls with antiseptic lotion and whitewashing should be insisted on in permanent sheds.

Black-quarter or quarter ill, black leg or quarter evil.—This disease was until recently supposed to be a kind of anthrax. It is an infectious bacterial disease manifested by high temperature, lameness and a localized hot, painful swelling on the shoulders, quarter, neck, leg, trunk or elsewhere. The swellings mostly occur in the limbs and quarters, and hence the name black-quarter. Cattle of all ages are liable to infection ; but the disease begins in animals under two years of age and rarely in adult cattle. Suckling calves fed only on milk are free. It is a disease that is worst in low-lying marshy pastures.

The swelling at first is small, hot, tender and pits on pressure. It extends to 12 inches or more in diameter in a few hours, and becomes dry and parchment like. Decomposition takes place inside ; the swelling becomes cold, the parts inside gangrenous, and the skin becomes insensible.

Preventive treatment consists in changing the pasture, and in inoculating healthy animals with black-quarter vaccine, which is prepared out of muscle-juice from an infected part The ends of the ears and the tail are the seats of inoculation, which should be done with proper antiseptic precautions by a trained veterinarian. Sick animals should be isolated at once and strict, disinfection should be carried out A dose of linseed oil (1 pint) with a dram of carbolic acid may be given without delay. The tumours in several places may be scarified and a saturated solution of potassium permanganate may be applied, or strong antiseptics or

caustics as pure carbolic acid or equal parts of turpentine tincture of iodine and liquor ammonia may be applied. In animals that recover, internal tonics as tincture ferri perchloride, 1 ounce in a pint of water may be given once daily, and externally the diseased parts will have to be treated surgically as wounds or abscesses.

Choking.—Cattle are sometimes choked with pieces of oil cake, palmyra nuts, stalks of cholam. The animal is uneasy and restless and there is no rumination. It coughs and salivates and, when it attempts to drink, water returns through the nostrils. If the obstruction can be reached by the hand, attempt must be made to remove it. If the impaction be lower down in the gullet beyond the reach of the hand, pour down the throat a little oil and then work the obstacle up and down when it may be dislodged and will descend into the stomach. Should this prove unsuccessful, the probang ought to be used and, in the absence of one, a rattan 6 feet long and half an inch in diameter covered at one end with soft cloth or wash leather may be substituted. The mouth must be kept open by the introduction across it of a piece of wood with a hole in the centre to allow of the cane being passed through. The obstruction must be gently pushed down into the stomach.

Tympanitis ; *Hoven.*—A common complaint among cattle in India. It is due to the distension of the rumen with gas. The cause is generally a too free use of succulent fodder or grass. There is uneasiness and pain, and a swelling on the left side of the belly, which, when struck, sounds like a drum. The animal is unable to breathe freely and grunts. In severe cases, relief should be afforded at once or the animal may die of suffocation. Give at once a pint of linseed oil with an ounce of turpentine in it (see also Recipes) and administer enemas of warm water. Should relief be not obtained in a few hours, and should the symptoms become aggravated, puncture the rumen with a trocar and canula on the left side at a point equally distant from the point of the hip, the last rib and the transverse processes of the lumbar vertebræ. If this instrument is not to be had, plunge the large blade of a pocket knife into the stomach and turn it crossways, when the gas will escape.

Impaction of the rumen.—This is distension of the rumen with food. Some particular foods are liable to cause this disorder, but anything particularly palatable and eaten to excess may produce the disease. The abdomen is distended on the left side but percussion elicits a dull sound and the swelling pits on pressure. If not relieved soon enough,

tympanitis may supervene and the animal may die of suffocation. Give immediately an oil purgative with a strong stimulant, linseed or castor oil two pints, croton oil thirty minims, powdered ginger one ounce. Administer copious and frequent enemas of warm water. Should relief be not obtained by the above measures, the only remedy is to perform "ruminotomy," that is, to cut into the stomach and remove its contents through the incision. This operation should only be attempted by a practised hand.

Diarrhœa.—Frequent evacuations of excessively fluid fæces. The causes are many, such as unwholesome food, free consumption of fresh young grass springing up after rains, scanty pasturage in the hot weather, sudden change of food from dry to green, change of seasons from hot to cold and *vice versâ.* Impure water may also cause diarrhœa. In most cases, it would be well to clear the bowels with a laxative dose of castor or linseed oil—15 ounces of oil with a dram of ganja. The food must be carefully examined, and changed if necessary. Should diarrhœa persist, give daily for a few days an astringent drench (see Recipes).

Dysentery.—This is caused by inflammation of the membrane lining the bowels. It is a frequent accompaniment of blood disorders. Simple dysentery may follow protracted and neglected diarrhœa, or may originate from exposure to cold, coarse, innutritious food or fodder, impure water, etc. It may also be an after-effect of poisonous agents. Give once daily or on alternate days, according to the nature of the case 8 ounces of linseed oil with a dram of ganja or of opium. Rub the flanks well with equal parts of mustard and turpentine. A course of astringents may also be administered if necessary (see Recipes).

Hepatitis.—Inflammation of the liver. It may be caused by an excessive amount of highly stimulating food associated with want of exercise. The disease is also attributed to changes of temperature and of food. It is most frequent in the hot weather. Fever may be present. The eyes and the skin are yellow. There may be perceptible enlargement on the right side with tenderness on pressure. Give frequent saline purgatives so as to keep the bowels loose for a week or ten days. Then give once or twice daily for a few days 2 drams each of camphor, aniseed and fenugreek in a pint of warm gruel.

Bronchitis.—Inflammation of the trachea and bronchial tubes. It is usually acute but may be chronic. The common causes are exposure to cold and dampness, sudden changes of temperature or over exertion. The disease begins with a

chill followed by high fever. The respirations are hurried. There is cough, which in the early stage is dry, but in the later stages becomes moist, with a mucous discharge from the mouth and nostrils. The bowels are generally costive. Administer enemas and a saline purgative. The air passages may be steamed and stimulating applications rubbed on the sides of the chest and the course of the trachea. The patient must be allowed a free supply of pure air, of tempting food and of nitrated drinking water—2 ounces of nitre dissolved in a gallon of water. Later, give a few expectorant drenches (see Recipes).

Young calves are subject to a parasitical bronchitis called "husk" or "hoose." This is caused by a species of thread worm known as *Strongylus micrurus*. There is a husky cough. Give ½ ounce of turpentine in 3 ounces of linseed oil twice a week. Fumigation with chlorine, carbolic acid or sulphur is supposed to kill the parasite.

Pneumonia; *Inflammation of the lungs.*—This disease may be accompanied with pleurisy (inflammation of the pleura). The causes are the same as those of bronchitis. There is quick and laborious breathing; the mouth is hot but the horns, ears and feet are often excessively cold. There is also a frequent sore cough. Give an aperient of Epsom salts and a free supply of nitrated water to drink. The patient must be well housed and kept warm. Rub turpentine on the chest twice daily, until it becomes slightly sore. A seton may be inserted in the dewlap.

Red water; *Black water.*—This disease sometimes shows itself in cows after calving. The urinary organs get irritated and the cow strains frequently and passes urine in small quantities tinged with blood. Later, the secretion may become black or brownish black. Keep the cow quiet and give her drinks of linseed tea or of thin rice gruel in which some nitre should be dissolved. Three or four ounces of Epsom salts may be given once daily in the form of a drench for about a week.

Nephritis; *Inflammation of the kidney.*—This is a frequent complaint in cattle, specially working bullocks, as a result of violent strains or blows on the loins. It may also arise from sudden changes in the temperature and exposure to wet and cold. There are general febrile symptoms. If both kidneys are affected, no urine is passed; if only one, a diminished supply of a thick, viscid character containing blood and pus is passed in small quantities with straining. When pressed on the loins, the animal flinches. The gait is straddling and painful. Foment the loins with warm water

frequently and give warm enemas. Administer 8 or 10 ounces of linseed oil with a dram of opium and repeat on the following day if necessary. Give linseed tea to drink freely.

Mange.—A contagious disorder of the skin due to the ravages of a mite known as "*Acarus bovis.*" There are many forms of this mite, but the most frequent one is *Dermatodectes bovis*. Debility, poverty of condition and uncleanliness are predisposing causes. There is intolerable itching, the affected parts become sore, the hair falls off and the skin becomes thickened and drawn in folds or wrinkles. The parts primarily affected are the hump and the tail, from which the disease may extend to other parts. All animals affected should be carefully isolated. Wash them well with soap and water and then rub in ointment made up of sulphur four parts, linseed oil eight parts, turpentine two parts. Any of the antiparasitics given under Recipes may also be used. Give also internally once daily for a few days 2 ounces common salt and 4 ounces sulphur, mixed with food, or as a drench in a pint of water.

Lousiness.—This is very common in cattle, specially in animals in poor condition. Several different forms of lice are known to attack cattle. Dress with tobacco infusion or some other antiparasitic dressing mentioned under Recipes. The dressings require to be several times repeated and well rubbed in. The animals should be thoroughly washed an hour or two after each application.

Ringworm.—This is due to vegetable parasites—fungi—growing upon the skin. Two forms are known in cattle, *Tinea tonsurans* (common ringworm) and *Tinea favosa* (honeycomb ringworm). Round patches are formed devoid of hair and covered with a greyish, yellow scurf. Dress the affected parts with corrosive sublimate lotion or rub in red iodide of mercury ointment.

Foul.—An irritative inflammation and ulceration between the digits, usually caused by animals standing in a filthy wet yard or on soft, wet, marshy pastures. The treatment consists of the removal of the affected animals to a dry place. The feet must be washed with phenyle or carbolic lotion, and then dressed with tar mixed with a little powdered sulphate of copper.

Laminitis.—Inflammation of the sensitive structure of the foot. This complaint is not very frequent in cattle, but sometimes occurs in highly-fed animals ; it may also be caused

by overdriving. Working cattle are most liable. Some or all the feet may be affected. Give a cathartic, rest the animal, and continuously apply cold water to the affected feet.

Conjunctivitis, simple ophthalmia.—Results from injuries and from entry of foreign matter into the eye. The eye is red and congested, tears flow freely from it and the patient cannot bear exposure to the light. Seek and remove the cause. Then bathe the eye freely with cold water. Following this, put into the eye a few drops of alum or zinc or boric lotion (see Collyria under Recipes). If any opacity o the cornea should result, dress the eye with silver nitrate lotion - 5 grains to an ounce of water.

Worm in the eye.—The worm is *Filaria lachrymalis.* It does not, as in the horse, live within the aqueous chamber of the eye but on the surface of the cornea, and lodges at the inner angle under the haw. There may be one worm or several. The affected eye is partially closed and continually waters. Cast the animal and bathe the eye freely with cold water. The worms, if present, can be got at by lifting up the haw. They must be picked up with forceps and removed.

Paralysis.—This is characterized by total or partial loss of sensibility or motion or both in some part or parts of the body. The most usual form in which the disease is met with in cattle, is the affection of the hind quarters known as *paraplegia.* Causes are injuries to the spine, overloading (in pack bullocks), sudden changes of temperature and exposure to wet and cold. The animal is unable to move freely, and drags the hind quarters. The gait is unsteady and staggering. Give a purgative to clear out the bowels. Apply a blister of red iodide of mercury to the loins (see Irritants under Recipes) and give daily for about a month half a dram of powdered nux-vomica in food or as drench.

Milk fever; parturient apoplexy; dropping after calving.—A disease peculiar to the cow which occurs after calving and within 10 days of it. In rare instances it is seen during or immediately prior to the birth of the calf. The disease is one of the nervous system and induces a partial or total loss of power. It is due to the formation of a certain ferment or toxin (poison) in the udder, which is absorbed and causes this nervous disorder. It chiefly affects deep milkers, and one attack predisposes to a second. The animal has a wild look and the gait is staggering. It lies in a state of torpor and moans. There is no discharge of dung or urine. The mouth opens and saliva flows from it. If any gruel is given,

it runs out of the mouth without the cow making any attempt to swallow it. The disease is very fatal. Its duration is one or two days. Treatment should be prompt. Give a strong purgative—1½ lb of Epsom salts with an ounce of aloes in two or three quarts of water. Copious warm enemas with castor oil or soap in them should be administered. Thin rice conjee or linseed tea hould be given warm, and, if the patient does not take it, should be gently poured down the throat. The up-to-date treatment for milk fever is the injection of oxygen or atmospheric air or any antiseptic lotion into the udder through the teat after milking the cow thoroughly dry, with the necessary antiseptic precautions ; this needs the attendance of a professional man. If the animal recovers, it must be kept for some time on digestible and laxative food, or better on a gruel diet with some green grass, and receive a course of tonics.

Fracture of the horn.—This often occurs from animals fighting or from an accident. The horn core may be fractured transversely without injury of the horn. The latter acts as splints, and no particular treatment is necessary beyond rest and a cold bandage round the horn. In some cases the horn alone is stripped off without the core being injured. In such cases clean the core gently with carbolic lotion and cover it with tarred tow and then with a bandage. When both core and horn are broken off, the rough projections and broken fragments of bone must be removed and sawn level. The bleeding may be stopped with a hot iron and the part dressed as above.

Sprain.—The muscles and tendons or ligaments of the joint of the leg may become sprained, and swelling, heat and pain of the affected part with lameness, may result. Foment the part with hot water till heat and pain pass off. Then keep a cold bandage on or make the animal stand in cold water for a couple of hours daily. If this does not complete the cure, and if any swelling still remains, rub in a blister of red iodide of mercury.

Mislocation or luxation.—From accident or over-exertion, a bone may be put out of joint. In working cattle the arm bone is perhaps the most frequently dislocated. The reduction is to be effected by casting the animal, and seizing the arm and pulling it downwards, when the bone may be heard to return to its socket with a snap. After this, rest and cold applications to the part are all that are necessary.

Wounds and tumours.—In case of injuries to the skin and in wounds generally, wash the parts with clean water freely,

and then dress them with some antiseptic dressing (see Antiseptic Recipes). The necks of working cattle are liable to be galled in various ways. In case of simple abrasion, the treatment is the same as for wounds. If the neck be inflamed and swollen, foment with hot water twice daily for two or three days, after which apply cold water freely and frequently. Should any swelling still persist, blister the part with mercury or mylabris ointment. Sometimes an abscess may form, which must be opened and the contents removed and the part treated as a wound. If there be any longstanding cold and well circumscribed tumour, it should be dissected out surgically.

Abortion ; Miscarriage.—Abortion may happen at any period between the first and the seventh month of pregnancy. If it occurs after the seventh month, it is called miscarriage and the young animal is born alive and is able to live for a longer or shorter period. Some of the causes of abortion are injuries, fright or excitement, over-driving, the presence of fungi on the fodder, exposure to cold, debility, etc. Pregnant animals affected with blood diseases generally abort. Sometimes abortion is due to bacterial organisms and in such cases it may range as an enzootic. In every case the safest plan is to segregate the cow that has aborted, to bury the calf and the cleansing deeply in the ground and to disinfect the stall. The animal should be nursed and carefully watched. As a rule, the fœtal membranes are passed investing the fœtus but if not and if they are retained unduly long, they should be removed with the hand. An aperient of Epsom salts should be given to the cow. Cows that have once aborted are liable to do so at about the same stage during future pregnancies.

Retention of after-birth or placenta.—The placenta comes away from ½ to 4 hours after the birth of the calf. The cow must be watched till the after-birth drops, when it should be removed and buried. Sometimes the placenta is retained for several days without any constitutional disturbances being set up. There is no danger whatsoever in allowing it to remain for two or three days. If it is retained beyond this, it may be removed with the hand. The practice of removing the placenta forcibly when it is retained a little beyond the usual time is to be condemned.

Inversion of the womb ; Downfall of the calf bag.—This may occur after calving, specially when there has been difficult labour. After the calf is born, the cow continues to strain until the uterus is forced out. Administer a dram of ganja or

of opium in gruel to quiet the animal, and make it stand with the hinder parts elevated. The uterus should be carefully washed with warm water containing a small quantity of carbolic acid or some other antiseptic. The closed fist should then be applied to the fundus of the organ, which must be gradually and gently pushed inwards. Stitches may be passed through the lips of the vulva to keep the uterus in its place. The stitches can be left for about 24 hours or until all straining has stopped. In some cases, a truss made of rope can be arranged so that it will press against the vagina.

Mammitis; Garget; Down fall of the udder.—Inflammation of the mammary gland is frequent in the cow. Exposure to cold, injuries of various kinds, obstruction of the flow of milk, allowing the animal to remain too long without milking may be enumerated as causes. Foot-and-mouth disease and cow-pox may also induce the disease. Mammitis often occurs soon after parturition and is caused by sudden overdistension of the part from a rush of new milk. The udder becomes enlarged, hot and tender and pits on pressure. The calf should be put to the mother frequently and the milk drawn away gently, so that the udder may be emptied. The part should be fomented with warm water freely two or three times a day and dressed with camphor oil after each fomentation. The patient should have a pound of Epsom salts given in warm water. The udder can be supported with a broad bandage. Abscesses should be looked for and at the first indication they should be opened, the matter let out and the opening dressed with carbolic oil.

Sore-teats.—This, like garget, often occurs after calving. Cracks and sores form on the teats causing much uneasiness when the cow is milked. Before milking, foment the teats with warm water, in which some alum has been dissolved. After milking dress the teats with boric liniment made in butter, ghi or coconut oil.

Savel ill.—Occasionally calves suffer from this owing to the abrupt or imperfect separation of the navel cord, and the navel bleeds. Should the cord be of sufficient length, it may be ligatured, but if close to the abdomen, apply a little powdered sulphate of copper or touch it with the point of a heated iron. Sometimes an abscess may form, which must be opened at once and dressed with carbolic oil. An abscess may lead to inflammation of the peritoneum and occasion the death of the calf.

Costiveness in the newly born calf.—The best medicine is the cow's first milk. If there is any necessity for an aperient

being given, administer in half a pint of rice gruel 2 ounces of castor oil with half a dram of ginger powder.

Scour ; Diarrhœa in calves.—This is caused by indigestion brought on by repletion. At other times the disease may be produced by the free eating of young tender grass. Starvation or want of sufficient nourishment may also induce the disease. The first thing to do is to administer a mild aperient —2 ounces of castor oil in half a pint of gruel. Then put the calf on a course of some cordial like the following – powdered chalk 2 ounces, powdered catechu 1 ounce, powdered ginger ½ ounce, ginger 1 dram, infusion of coriander 1 pint ; dose, 1 to 2 ounces, 2 or 3 times a day.

The Sheep.

The sheep is a mammal belonging to the order *Ungulata*, group *Ruminantia*, family *Ovidae*, genus *Ovis* and species *Ovis aries*,

The chief breeds of Southern India are—

The Madras or South Indian.—This breed is found over the whole Presidency. The sheep have tucked up bellies, light feet, bony limbs, flat sides and short tail. Only the rams have horns. They are covered with short coarse hair, whose colour is generally red or brown. They have, as a rule, a couple of pendulous lobules hanging from the throat, known in Tamil as " Munnies '.' that is, bells.

The Nellore.—The sheep are large in size and about the tallest in India. The average live weight of adult animals is 80 to 100 lb. The rams have twisted horns. The ewes are hornless. The prevailing colour is white or a light brownish-white. The body is densely covered with short hair.

The Coimbatore.—The district has, in addition to the Madras breed, a breed of wool-producing sheep. The prevailing colour is white with a black head, sometimes also black neck. The sheep have a fine covering of wool. They have good square compact carcases. They fatten rapidly, and they yield mutton of a superior quality. Full grown animals weigh from 50 to 60 lb.

The Mysore.—This province is noted for a woolly breed of sheep. The rams have well twisted horns but the ewes are, as a rule, hornless. The usual colour is a light to a dark grey or black. Live weight of adult animal is 40 to 60 lb. They are not unlike the Coimbatore in point of build and size. The sheep of this breed are prone to pugnacity, and

furnish the chief fighting rams in Southern India. The breed has been improved from time to time by being crossed with Merino rams.

Patna in Bengal is noted for a breed of woolly sheep of good size and form and yielding very good mutton. Some rams of this breed were imported in the Government Farm, Saidapet, and they throve remarkably well and stood the hot weather much better than the Nellore, which were present in the flock at the time.

Names of Sheep.

Male.

Until weaned, suckling. After weaning until a year old, ram lamb; if castrated, a wether. Afterwards a two-year ram or wether, a three-year ram or wether and then an aged ram or wether.

In the case of woolly sheep, the ram lamb when shorn at the end of the first year becomes a shearling, then a two-shear ram, then a three-shear ram and then aged.

Female.

Until weaned, suckling. Until a year old, ewe lamb. After a year old until it drops a lamb, a gimmer; if in lamb, gimmer in lamb, if not, barren gimmer, if not put to the ram, a yeld gimmer. After a gimmer has lambed, she is called an ewe, two-year, three-year, aged.

In the case of woolly sheep, the terms used are the same as those for rams, namely, shearling ewe, two-shear ewe, three-shear ewe, aged ewe.

Breeding and Rearing.

Sheep are bred in India for mutton alone or for mutton and wool. The wool should be fine and long and free from hair. The ewes kept for breeding should be carefully selected. They should have a good conformation and, in the case of woolly sheep, a good fleece, especially over the belly. They should be between 1 and 3 years old. Old and ill-formed and defective animals should be weeded out from the flock. One ram will suffice for 50 ewes. The breeding rams are allowed to run with the ewes always. Under these conditions, all over Southern India, generally, the ewes take the ram from February to March and the lambs are dropped from July to August. The average period of gestation in

sheep is 150 days or roughly 5 months. The lambs can be weaned when 3 to 6 months old. Rams are not castrated until they are about a year old, but lamb castration performed a fortnight or a month after birth is probably desirable. The weight of a lamb at birth is about one-twelfth of the weight of the dam. A sheep attains its full growth and weight at the age of three years. About two-thirds of the weight is attained in the first year and the greater part of the remainder during the second year.

Feeding.—The sheep are fed on pastures only and are kept out in the open air all the year round. In the hot weather when the pastures are bare, the animals fall in condition considerably. No provision of any artificial food or of any fodder, green or dry, for such seasons is made.

Shearing.—In India the sheep are clipped once yearly either in the hot and dry part of the year, April to May, or in the cold dry season, January to February. They are clipped for the first time when they are a year old. The sheep are washed generally before they are shorn. The washing is done on the same day or the day before.

Dentition.—The dentition of the sheep resembles that of cattle as to the number of teeth and their position. The teeth of the sheep are also similar to those of cattle but much smaller. As in cattle, the front part of the upper jaw has no teeth and has, in their place, a dense fibrous pad. There are two sets of teeth, milk and permanent. The milk set consists of eight incisors in the front part of the lower jaw and three molars (known as premolars) on each side of each jaw, that is 20 in all. All these are replaced later on by permanent teeth and three more molars on each side of each jaw behind the premolars come up once for all, so that the total number of permanent teeth is 32.

Dental formula for milk teeth.

Incisors $\frac{0\text{–}0}{4\text{–}4}$, premolars. $\frac{3\text{–}3}{3\text{–}3}$ Total 20.

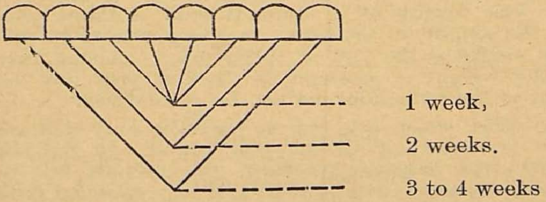
Dental formula for permanent teeth.

Incisors $\frac{0\text{–}0}{4\text{–}4}$, premolars $\frac{3\text{–}3}{3\text{–}3}$, molars $\frac{3\text{–}3}{3\text{–}3}$. Total 32.

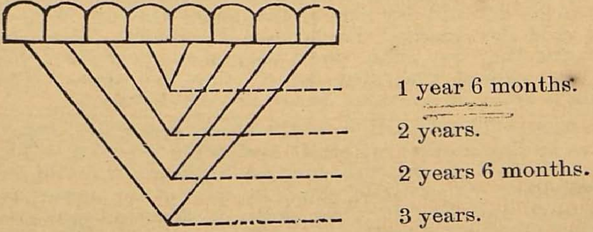
NOTE.—The top figures in each formula show the teeth on each side of the upper jaw, and the bottom figures, the teeth in the lower jaw.

Teeth indicating age.

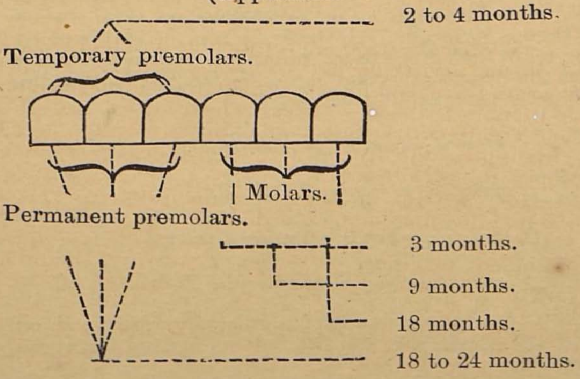
(Appearance of temporary incisors.)



(Appearance of permanent incisors.)



(Appearance of molars.)



LAMBING TABLE.

Average period of gestation, 150 days.

If served on		Will lamb about		If served on		Will lamb about	
January	1	May	31	July	1	November	28
„	14	June	13	„	14	December	11
February	1	July	1	August	1	„	29
„	14	„	16	„	14	January	11
March	1	„	29	September	1	„	29
„	14	August	11	„	14	February	11
April	1	„	29	October	1	„	28
„	14	September	11	„	14	March	13
May	1	„	28	November	1	„	31
„	14	October	11	„	14	April	13
June	1	„	29	December	1	„	30
„	14	November	11	„	14	May	13

COMMON DISEASES.

Foot-and-mouth disease—Epizootic aphtha.—(See the description under cattle.) In sheep the feet are chiefly affected and the mouth seldom. Some of the milder applications mentioned under antiseptics (see Recipes) may be used. The disease is infectious and contagious but causes little mortality.

Sheep-pox—Variola ovina.—A formidable and highly fatal disease in sheep, infectious and contagious. First, reddish spots appear on the naked places, which then turn into red or purple circumscribed vesicles, which often run into each other. Treatment is of no avail. Every attempt should be made to suppress the disease and dead animals should be buried deep with quicklime.

Rinderpest.—(See the description under cattle.) This is also a highly infectious and fatal disease. In virulent outbreaks, 80 per cent may die. There is fever, blisters in the mouth and bloody diarrhœa. Preventive measures should be adopted and dead animals should be buried in deep pits with quicklime.

Anthrax.—In sheep, it runs the same course as in cattle (see above) and is highly fatal.

Treatment.—5 to 10 minims of carbolic acid in three to four ounces of linseed oil may be given. Precautionary measures such as segregation and disinfection should be adopted as mentioned in the case of cattle. This disease should not be confused with Braxy.

Scrofula Tuberculosis—A specific disease and somewhat infectious. The respiratory organs are often affected, sometimes the abdominal organs. It is very liable to appear in animals which are inbred and which are in a fat condition. There is slow fever and the animal pines away. An attack of diarrhœa carries off the animal in the end. The best thing is to slaughter the animal as soon as the symptoms are noticed. If the disease has not made much progress, the flesh can be eaten well boiled.

Rabies—Hydrophobia.—This is produced by the bite of a rabid dog or jackal. After a varying period of incubation after the animal has been bitten, it begins to behave strangely and butts other sheep furiously. The breathing becomes hurried and saliva flows freely from the mouth. The patient dies within a week. There is no treatment and a rabid sheep should be destroyed at once. Should there be suspicion that a sheep has been bitten by a rabid animal, the best thing is to kill it forthwith. The mutton can be used well cooked.

Contagious footrot.—This is a specific disease. The hoof softens and loosens from the tissues inside. There is suppuration and fungoid growth on the coronet. Fortunately this disease is rare. Make a solution of carbolic acid or of sulphate of copper in a large tub and dip the feet of the affected sheep once daily.

Catarrh or cold.—A very common complaint during wet and cold weather. There is slight cough and copious discharge of mucus from the nostrils. The patient may also be feverish. Rest and quiet is all that is necessary. A couple of ounces of Epsom salts with half a dram of powdered ginger may be given as a drench in half a pint of water.

Bronchitis.—This may be the result of a neglected catarrh or may originate from the same causes as catarrh. There is severe cough and profuse discharge from the nostrils. The appetite is lost, the breathing is hurried and the bowels are costive. Fever is generally present at the commencement. Give once daily for two or three days an ounce of Epsom salts, a dram of nitre and half a dram of ginger powder in half a pint of warm water. In severe cases, rub some stimulating liniment or turpentine on the throat.

Pneumonia—Inflammation of the lungs.—This is a dangerous disease in sheep. There is fever, hard breathing, much

cough and some mucous discharge from the nostrils. Rumination is suspended and food is refused. There is heaving of the flanks and a staggering gait. The disease may prove fatal in a couple of days. Treat in the same way as bronchitis. Rub in powdered mustard or turpentine over the throat and chest until the parts are slightly blistered.

Aphtha.—This sometimes breaks out in a flock, as a rule in the cold weather. Lambs and young sheep are chiefly affected. The disease is probably contagious. There is a dense crop of warty growths on the lips and the muzzle. They soon become ulcerated and fungoid and run into each other. Mortality, however, is not marked. Wash the parts once daily with carbolic lotion and then dress with boric ointment.

Hoven—Tympanitis—Distention of the rumen with gas.—It is generally caused by the consumption of young succulent grass. There is swelling on the left side of the belly, which when struck sounds like a drum. The patient evinces uneasiness and pain. Give at once in half a pint of warm water, Epsom salts 3 ounces, ginger 2 drams and slaked lime 20 grains.

Diarrhœa.—This may arise from the same causes as tympanitis or from a change of pasture or from change of weather. There is excessive purging, loss of flesh and weakness. Give shelter and dry nourishing food. Change pasture, if possible. Give repeated doses of some cordial (see Recipes) or the following twice daily for a couple of days : Powdered gallnut half a dram, powdered omum half a dram, chalk or slaked lime 20 grains, powdered ganja 10 grains, in half a pint of warm gruel or infusion of linseed.

Dysentery—Bloody flux.---This is inflammation of the mucous membrane of the intestines. This is a much more dangerous and fatal disease than diarrhœa. There is sometimes an outbreak of dysentery in a flock, which is probably a contagious form of the disease. There is fever, the stools become frequent, are mixed with blood and slime and are voided with pain and straining. Give once daily for a couple of days 2 ounces of castor oil with 10 grains of powdered ganja in half a pint of warm gruel. Should the purging continue after this, give catechu half a dram, powdered ginger half a dram, chalk one dram, in half a pint of warm infusion of linseed once daily.

Rot—Liver rot.—Thisis very destructive disease. It sometimes breaks out in a flock during the hot weather. It is due to the presence of flukes—*Distoma* or *Fasciola hepatica*—in the substance of the liver, gall-bladder and biliary

ducts. Sheep infested with the fluke lose flesh gradually. The eyes are dull and tinged yellow. The bowels are costive at first but, later, violent purging begins and the faeces are fetid and tinged with blood. Dropsy sets in and is particularly marked as a swelling under the jaw, and the disease terminates generally fatally, from three to seven days. After this, treatment should, if possible, consist in the removal of the flock to an open dry pasture. The animals should have a little cake in addition to grazing. Common salt and sulphate of iron powdered may be given mixed with cake or as a drench at the rate of 1½ drams of common salt and half a scruple of sulphate of iron per adult head.

Tetanus, Trismus or lock-jaw, is an infectious disease which may attack the ox but more commonly sheep and goats. It is caused by the Tetanus bacillus which infects wounds and causes a general poisoning of the nervous system. Tetanus is of two kinds: Traumatic and Idiopathic. In the former the wound is seen anywhere over the body, in the latter the wound or abrasion is believed to be either in the mouth or in the alimentary tract. The period of incubation is two or three days. The animal is nervous and excitable with rigidity of the muscles of the neck. There is quivering, stiffening and elevation of the tail. There is also fever with excessive thirst. The symptoms increase in one, two or three days. All the muscles of the head and neck gradually become stiff, the nose is poked forward, the nostrils dilated and the haw of the eye protruded. The jaw is fixed, and there is complete loss of power to masticate. The animal stands stiff with the fore legs propped out for support and when it moves the legs appear to be jointless. As the disease progresses there is general rigidity of the muscles and the animal falls down with spasms, and, unable to get up struggles till death.

Treatment.—In the early stages before the lower jaw gets fixed, give a strong purgative. Four ounces of Epsom salt, two drops of croton oil and a dram of ginger in half a pint of water may be given and subsequently administer on the following days sedatives such as ganja, opium, belladona or chloral hydras. in ten grain doses mixed with a little jaggery or honey and rubbed on the tongue and palate twice daily. Careful nursing is necessary. The animal should be kept as quiet as possible and in a dark but well-ventilated shed. The wound, if any, should be thoroughly cleansed with strong antiseptic lotion and touched with pure carbolic acid or silver nitrate. Soft liquid food should be given.

Scab.—This is a contagious skin disease due to the ravages of a minute acarus—*Acarus ovis* or *Dermatodectes ovis.* The disease is known by the following symptoms: The animal shows uneasiness, wool comes away in locks and the parts denuded of wool exhibit pustules. The patient attempts to bite or strike with the feet the parts diseased, and rubs itself against a tree, stone or any other hard object. The affected sheep should be well washed with soapnut powder and water daily. Occasionally, about half an hour before washing, they may be dressed with an infusion of tobacco—half a pound of tobacco to 4 gallons of water. This should not be repeated too often, as tobacco is liable to be absorbed and to kill the patient. Any of the antiparasitic lotions given under "Recipes" may also be used. Salt should be placed before the animals to lick at pleasure.

The Gad fly.—A species of the gad fly, *Oestrus ovis*, infests sheep and deposits its ova about the nose and the lips. The larvæ, when hatched, creep into the nostrils and make their way up into the frontal sinuses, where they remain for about a year feeding upon the mucus. The maggots do not cause any irritation unless they are in large numbers. No treatment is necessary, and it is not possible to find out the affected animals.

Lousiness.—The sheep louse is *Hippobosca ovina.* It is generally associated with scab. Treatment is the same as that for scab.

Ticks.—Sheep are sometimes infested with ticks. There are species peculiar to the sheep but dog ticks may also attack them. Ticks prefer the ears and the region of the neck and shoulders. When lambs are infested, they suffer much and their growth is arrested. Sponge the affected parts with tobacco infusion and then dress them with lamp oil.

Flies.—Many of the Muscidæ, particularly the Blue bottle fly, *Musca vomitoria*, and the Flesh fly, *Musca cæsar*, are very troublesome to sheep. They attack any part that may have a small abrasion or sore, and deposit eggs thereon. The larvæ familiarly known as maggots, are soon hatched and they infest the sores and eat into them. Dress the sores with a saturated solution of camphor in oil, to which a little kerosene oil may be added.

Abortion.—This is not at all uncommon in ewes and is brought about by various causes. No particular treatment is necessary. Placing the ewes for a few days in a sheltered place and nursing them will suffice.

Garget or inflammation of the udder.—This is of frequent occurrence. Exposure to wet and cold, moisture and filth in the places where sheep lie down, wounds and injuries to the udder are amongst the causes. The udder becomes hot, hard and tender. Foment frequently with warm water and empty the udder of milk.

Recipes.

The recipes given below are for cattle and buffalos and the doses put down are for adult animals of those species, that is, those that have cut the first pair of teeth. For younger animals, the doses should be proportionately reduced. For calves under 6 months give one quarter of the adult dose. Many disorders are common to cattle, sheep and goats and in such, the same recipes may be employed for sheep and goats, the dose not being greater than that specified above for calves.

Alteratives and tonics.—Useful in debility, anæmia, during convalescence from debilitating disorders and in poverty of condition. To be given once daily for a week or more.

Drench—

(1)	Sulphate of iron	2 drams.
	Ginger, powdered	½ ounce.
	Chirata ,, ...	1 ounce.
	Warm water or gruel	1 pint.

Drench—

(2)	Sulphate of copper	1 dram.
	Nux-vomica, powdered	1 scruple.
	Coriander	½ ounce.
	Warm water or gruel	1 pint.

Powder or drench—

(3)	Sulphate of iron	1 dram.
	Nux-vomica, powdered	1 scruple.
	White arsenic	3 grains.
	Fenugreek, powdered	½ ounce.
	Aniseed	½ ounce.

Mix and give in food or as drench in a pint of water. This last recipe is very good when an animal is out of condition.

Anthelmintics, vermifuges.—These are given when an animal is suffering from worms. Begin with a strong

purgative (see purgatives), then give once daily for a fortnight the recipe No. 3 under 'alternatives' or the following :—

Powder—

Sulphate of iron	1 dram.
Sulphur	4 drams.
Sodium chloride	4 drams.

Mix and give in food.

Anæsthetics.—General and local anæsthesia is difficult to produce in ruminants and is seldom necessary.

General, to be given by inhalation—

(1) Chloroform or ether...	4 to 6 ounces.
(2) Chloroform	3 ounces.
Ether	3 ounces.

Local, chiefly for the examination of, and operations on, the eyes.

(3) Cocaine	1 part.
Distilled, rain, or soft clean water ...	20 parts.

Antipyretics, febrifuges.—These lower the temperature of the body in fevers.

(1) Give a saline purgative (see purgatives) and nitre in drinking water.

(2) Drench—

Magnesium sulphate	3 ounces.
Nitrate of potash	½ ounce.
Water	1 pint.

Give twice a day for 2 or 3 days.

Antiparasitics.—Useful in mange, lousiness, and against ticks.

Lotion—

(1) Carbolic acid or phenyle	1 part.
Water	52 to 80 parts.

(2) A strong decoction of margosa or nux vomica leaves.

(3) Tobacco leaf	½ ounce.
Water, hot	1 pint.
(4) Perchloride of mercury	1 part.
Water	500 parts.

N.B.—The last two must be employed with great caution especially when they are applied to the whole, or a large part of the body, as these drugs are liable to be absorbed and to endanger the life of the patient. Within three hours of the dressing, the animal should be washed with water and the application should not be repeated before the lapse of a week.

Liniment—

(5) Camphor	1 part.
Margosa oil	10 parts.
Coconut oil	20 parts.

Ointment—

(6) Carbolic acid	1 part.
Sulphur, sublimed or powdered ...	2 parts.
Lard	6 parts.

Antiseptics—

Internal, given in indigestion, tympanitis, etc.

Drench—

Carbolic acid	1 fluid dram.
Linseed oil	1 ounce.
Gruel	1 pint.

External, for wounds, ulcers, etc.

Lotions—

(1) Carbolic acid or phenyle	1 part.
Water	20 to 40 parts.
(2) Boric acid	1 part.
Water (hot preferable)...	20 parts.
(3) Permanganate of potash	4 grains.
Water	1 ounce.
(4) Perchloride of mercury	2 grains.
Water	1 ounce.

Liniments—

(5) Carbolic acid	1 part.
Coconut oil	10 to 12 parts.
(6) Iodoform	1 part.
Carbolic acid	1 part.
Turpentine	2 parts.
Camphor	1 part.
Tobacco snuff	½ part.
Coconut oil	20 parts.

N.B.—A very good detergent for foul wounds infested with maggots.

Powders—

(1)	Iodoform	1 part.
	Boric acid	2 parts.
(8)	Chalk	15 parts.
	Carbolic acid	1 part.

Ointments—

(9)	Carbolic acid	1 part.
	Lard	8 parts.
(10)	Boric acid	1 part.
	Lard	4 parts.

(11) Common tar, Resin, Lard — Of each equal parts.

N.B.—Melt and mix over a gentle fire. Useful in footrot in sheep, and in foul in cattle.

Astringents—

Internal, for diarrhœa, dysentery, etc.

Drenches to be given twice daily—

(1)	Gallnut, powdered	3 drams.
	Chirata, powdered	4 drams.
	Fenugreek, powdered	4 drams.
	Gruel	1 pint.
(2)	Catechu, powdered	2 drams.
	Camphor	2 drams.
	Bael fruit, powdered	4 drams.
	Gruel	1 pint.

(3) Decoction of the leaves and the rind of the fruit of the pomegranate tree.

External, for wounds and ulcers, and for stopping capillary bleeding.

Lotions—

(1)	Alum, or zinc sulphate or sulphate of copper	1 ounce.
	Water	6 to 10 ounces.

Powders—

(2) Alum, Sulphate of iron, Sulphate of zinc — Of each equal parts.

(3) Galls, powdered, Catechu — Of each equal parts.

Collyria or eye washes useful in conjunctivitis :—

(1)	Alum or sulphate of zinc or sulphate of copper	5 to 10 grains.
	Water	1 ounce.
(2)	Alum	5 grains.
	Zinc sulphate	5 grains.
	Boric acid	10 grains.
	Water	1 ounce.
(3)	Silver nitrate	5 to 10 grains.
	Water	1 ounce.

NOTE,.—5 to 10 minims of tincture of opium may be added to each of the above as an anodyne.

Gargles in simple and epizootic aphtha, for wounds in the mouth, etc. :—

(1)	Boric acid	20 grains.
	Water	1 ounce.
(2)	Alum	15 grains.
	Water	1 ounce.
(3)	Permanganate of potash	4 grains.
	Water	1 ounce.

Cordials and stimulants—useful in indigestion, flatulency and tympanitis :—

Drenches—

(1)	Ginger, powdered	4 drams.
	Cumin	4 drams.
	Asafetida	2 drams.
	Water	1 pint.
(2)	Ammonium carbonate	2 drams.
	Nux-vomica, powdered	½ dram.
	Water	1 pint.
(3)	Solution of ammonia	1 ounce.
	Turpentine	2 ounces.
	Aniseed, powdered	4 drams.
	Water	1½ pints.

Very strong and efficacious in tympanitis.

Disinfectants.—Internal, given as curative and preventative in specific blood diseases.

Recipes given under 'Antiseptics internal' may be employed.

External, for disinfecting cattle sheds, sheep pens and contaminated articles—

(1) Freshly slaked lime... ... ... 100 parts.
Carbolic acid ... ... 15 parts.
Mix thoroughly and sprinkle :

(2) Carbolic acid ... ... 3 ounces.
Water ... ... 1 gallon.

(3) Perchloride of mercury ... ... 1 ounce.
Water ... ... 1 gallon.

(4) Permanganate of potash ... ... $1\frac{1}{2}$ ounces.
Water ... ... 1 gallon.

(5) Chlorine gas and sulphur anhydride are very useful disinfectants.

(6) A good fire is the best disinfectant. All contaminated straw, litter, etc., should always be burnt.

Diuretics.—These increase the secretion of urine and are indicated in dropsical swellings, in fever and in dysuria.

Drenches —

(1) Nitrate of potash ... ... 3 drams.
Resin, powdered ... ... 3 drams.
Turpentine ... ... 2 drams.
Water ... ... 1 pint.

(2) Magnesium sulphate ... ... 3 ounces.
Nitrate of potash ... ... $\frac{1}{2}$ ounce.
Water ... ... 1 pint.

Demulcents and emollients.—These soften and soothe the parts to which they are applied.

Demulcents (internal).—Bland oils, linseed tea, gruel.

Emollients (external).—All non-irritating oils and fats, starch, powdered chalk, etc.

For burns and scalds, a very efficacious application is carron oil, prepared as follows :—

Solution of lime } Of each equal parts.
Coconut oil }

Ecbolics-parturients.—These make the womb contract and expel its contents.

Powder or tincture or extract of ergot ... 1 ounce.
Asafetida ... ... 2 drams.
Water ... ... 1 pint.

Expectorants.—These remove phlegm from the air passages and are given in cough, catarrh and lung affections.

Drenches—

(1) Ammonium carbonate		Of each 2 drams.
Asafetida		
Camphor		
Water		1 pint.
(2) Opium		1 dram.
Camphor		2 drams.
Turpentine		1 ounce.
Water or gruel		1 pint.

Irritants.—These are employed externally for counter-irritation in cases of sprains, sore-throat and inflammatory affections of the internal organs; as stimulants, detergent and caustic to unhealthy sores and ulcers; for bringing about absorption of bony tumours, enlarged glands and thickened integuments, and for ringworm.

Liniments—

(1) Solution of ammonia	1 ounce.
Turpentine	1 ounce.
Coconut oil	2 ounces.
(2) Mylabris, powdered	1 ounce.
Coconut oil	8 ounces.
(Digest over a hot bath.)	
(3) Mustard, powdered	4 ounces.
Turpentine	5 ounces.
Coconut oil	5 ounces.

Ointment—

(4) Mylabris in powder	1 part.
Lard	6 parts.
(5) Red iodide of mercury	1 part.
Lard	8 parts.

For bites of venomous reptiles and rabid animals apply immediately to the part undiluted carbolic acid or some other strong caustic.

Purgatives—

Mild—

Drenches—

(1) Magnesium sulphate ...	12 to 16 ounces.
Ginger, powdered	½ ounce.
Water	2 pints.
(2) Sodium chloride	1 lb.
Omum, powdered	½ ounce.
Water	2 pints.
(3) Castor oil or linseed oil ...	2 pints.
Infusion of ginger (1 ounce) ...	10 fluid ounce.

Strong—

Drenches—

(1)	Magnesium sulphate	1 lb.
	Aloe, powdered	1 ounce.
	Ginger	½ ounce.
	Water	2 pints.
(2)	Magnesium sulphate	1 lb.
	Gamboge, powdered	½ ounce.
	Aniseed	½ ounce.
	Water	2 pints.
(3)	Castor oil or linseed oil ...	2 pints.
	Croton oil	30 minims.
	Infusion of ginger	10 fluid ounces.

Weights and Measures and other Substitutes used in Veterinary Practice.

[Solid medicines are weighed. Liquid medicines are generally measured but may also be weighed.]

Solids.

60 grains	=	1 dram or drachm.
8 drams	=	1 ounce.
16 ounces ...	=	1 pound.
1 scruple ...	=	20 grains.
1 viss = 40 palams	=	3 pounds, 2 ounces = 120 tolas.
1 pound	=	$38\frac{2}{5}$ tolas.
1 palam	=	3 tolas = 1 ounce, 2 drams
1 tola	=	$3\frac{1}{3}$ drams.

Liquids.

60 minims ...	=	1 fluid dram.
8 fluid drams ...	=	1 fluid ounce.
16 fluid ounces ...	=	1 fluid pound.
1 pint	=	20 fluid ounces.
1 gallon=8 pints	=	160 fluid ounces = 10 fluid pounds.

1 Madras measure = $62\frac{1}{2}$ fluid ounces.

A bottle contains 20 to 25 ounces.

Medicinal Substances and Instruments which a Farmer should always have at hand.

Medicinal Substances.

Aloe.
Alum.
Arecanuts.
Asafetida.
Bicarbonate of soda.
Boric acid.
Camphor.
Carbolic acid, phenyl, cyllin or cresol.
Castor oil.
Catechu.
Chirata.
Coconut oil.
Croton oil.
Gallnuts.
Ganja.
Ginger.
Iodoform.
Sulphate of copper (blue stone).
Sulphate of iron.
Linseed ; linseed oil (raw).
Liquor ammoniæ.
Mylabris.
Nux-vomica.
Omum.
Perchloride of mercury.
Permanganate of potash.
Red iodide of mercury.
Saltpetre (nitre).
Slaked lime or chalk.
Sulphate of magnesia (Epsom salts).
Sulphate of zinc.
Sulphur.
Turpentine.
Tar.

Instruments and Appliances.

Dressing instruments :—Forceps, seton needles, suture needles, probe, a couple of scalpels, scissors.
Trocar and canula for tympanitis.
Enema funnel.
Firing irons.
Shoeing tools--drawing knife, pincers, buffer and hammer.
Castrating clamps.
Teat bistoury.
Probang or a piece of smooth flexible rattan about 6 feet long.
Drenching harn or bamboo or bottle.
Clinical thermometer.
Syringe.
A big knife for *post-mortem* examination.
Lint, tow, cotton and suture thread.

Periods of Gestation of Domestic Animals and of Incubation of Poultry.

Animals.	Shortest period.	Average or usual period.	Longest period.
	DAYS.	DAYS.	DAYS.
Mare	315	345	360
Ass	365	380	391
Cow	242	285	313
Buffalo	290	310	330
Ewe	145	150	160
Goat	148	155	165
Sow	109	115	143
Bitch	55	60	63
Cat	48	50	56
Rabbit	25	30	35
Hen sitting on hen eggs ...	19	21	23
" duck eggs ...	28	30	32
" turkey eggs.	26	28	30
Duck	28	30	32
Goose	27	30	33
Pigeon	18	20	21

Number of Females to each Male.

Mares	60
Cows and buffalos	50
Ewes	50
Goats	20
Sows	10
Hens	10
Ducks	10
Turkeys	8
Geese	4

Periods of Heat (Oestrum).

Animal.	Duration of heat.	First heat after birth of young.	Recurrences of heat.
Mare ...	5 to 7 days.	10 to 15 days ...	2 to 3 weeks.
Cow ...	1 to 2 ,,	1 to 3 months and more.	2 to 4 ,,
Buffalo ...	1 to 3 ,,	2 to 3 months and more.	3 to 4 ,,
Ewe ...	1 to 2 ,,	2 to 6 months ...	2 to 3 ,,
Goat ..	1 to 2 ,,	1 to 3 ,, ...	2 to 3 ,,
Sow ...	2 to 4 ,,	5 to 6 weeks ...	2 to 3 ,,

Pulse, Respiration and Temperature.

Animal.	Pulse.		Respiration per minute.	Temperature F.
	Beats per minute.	Where felt.		
Horse ...	35—45	Jaw	10—12	100—101
Cattle ...	50—60	Tail and jaw; in calves, arm and thigh also.	16—24	100·5 101·5
Buffalo ...	45—50	Tail and jaw ...	20—25	100—101
Sheep ...	60—80	Arm and thigh ...	30—40	102—104
Goat ...	60—70	Do. ...	25—30	101—103
Pig ...	70	Heart	15—25	102·5

The above figures are the average for adult animals while at rest. There are considerable individual variations and, consistently with health, variations in the same animal at different times and under different conditions. For instance, in sheep the number of respiratory acts may run up considerably on account of excitement or atmospheric temperature. In the young animal respiration is quicker and temperature slightly higher than in the adult. Exercise and digestion increase temperature and respiratory acts.

Disinfection.

An infected building is best disinfected with sulphur burnt inside, the doors and windows being closed. Cattle sheds can be disinfected with a 5 per cent solution of carbolic acid or a ½ per cent solution of corrosive sublimate or 1 per cent solution of permanganate of potash. All the wood work should be sponged with the solution and all corners and crevices should be well damped with it. Gutters should be flushed with the disinfectant lotion. If the floor be of mud, some litter may be burnt on it, and then it should be sprinkled with quick or freshly slaked lime, to which some carbolic acid may be added. Finally, the walls should be lime-washed, a little carbolic acid being added to the wash. See 'Disinfectants' under 'Recipes.'

Life of Animals.

	years.
Horse	35
Ass	30
Cattle	20
Buffalo	25
Sheep	10
Goat	15
Pig	20
Cat	12
Dog	12
Hare	7
Rabbit	7
Hen	14
Goose	80
Camel	60
Elephant	150

List of the principal Animal and Vegetable Parasites.

Scientific name.	Common name.	Attack.
Sub-kingdom, Vermes.		
Class, Platyhelmia (flat worms).		
Order, Cestoda or Tæniada (tape-worms).		
Cysticercus Cellulosus.	'Measles' in pork.	Muscles of the pig. Becomes common or armed tapeworm (*Tœnia Solum*) in man.
Cysticercus sp. ...	'Measles' or 'Bladder worm' of the ox.	Muscles of the ox. Becomes unarmed tapeworm (*Tœnia saginata*) in man.
Cœnerus Cerebralis ...	'Sturdy' in sheep.	Brain of the sheep. Becomes tapeworm (*Tœnia cœnurus*) in dog.
Tœnia expansa ...	...	Tapeworm in the ox, sheep and goats.
Order, Trematoda (flukes).		
Fasciola or *Distoma hepatica.*	'Fluke'—'rot'—'liver rot.'	Liver, gall bladder and biliary ducts of sheep.
Class Nemathelmia (round worms). Order Nematoda.		
Trichina spiralis ...	Flesh worm...	Muscles of man, pig, etc., cause trichiniasis.
Strongylus filaria ...	'Husk' in lambs.	Trachea and bronchial tubes of lambs.
Strongylus micrurus ...	'Husk' in calves.	Trachea and bronchial tubes of calves.

LIST OF THE PRINCIPAL ANIMAL AND VEGETABLE PARASITES—*cont.*

Scientific name.	Common name.	Attack.
Strongylus contortus or *Strongylus cervicornis.*	'Lamb disease.'	Fourth stomach of lambs. Causes gastro entèritis.
Oxyrus curvula ...	'Maw-worm'—'pinworm' 'thread worm.'	Rectum of the horse.
Oxyrus vermicularis ...	Thread worm.	Rectum of man.
Ascaris megalocephala.	Horse worm.	Intestines of the horse.
Ascaris lumbricoides bovis.	Round worm of ox.	Intestines of the ox.
Ascaris marginata ...	Round worm of dog.	Intestines of the dog.
Ascaris lumbricoides hominis.	Round worm of man.	Intestines of man.
Filaria lachrymalis equi.	Worm in the eye.	Within the aqueous chamber of the eye of the horse.
Filaria lachrymalis bovis.	Do.	On the surface of the cornea and at the inner canthus of the eye of the ox.
Sub-kingdom Arthropoda (jointed-limbed animals) Class, Arachnoidea (scorpions, spiders, mites). Order, Acaridea (mites).		
Sarcoptes hominis ...	'Itch'	Man.
Sarcoptes equi ...	'Sarcoptic mange.'	Horse.

List of the principal Animal and Vegetable Parasites—*cont.*

Scientific name.	Common name.	Attack.
Sarcoptes ovis ...	'Sarcoptic mange.'	Sheep.
Sarcoptes suis ...	'Mange' ...	Pig.
Sarcoptes canis ...	Do. ...	Dog.
Dermatodectes equi...	Do. ...	Horse.
Dermatodectes bovis.	Do. ...	Ox.
Dermatodectes ovis...	'Scab' ...	Sheep.
Ixodes ricinus ...	'Dog tick' ...	Dog, also man, ox and sheep.
Ixodes reduvius ...	'Sheep tick.'	Sheep and goats.
Ixodes reticulatus ...	'Ox tick' ...	Ox and also sheep and goats.
Class, Insecta. Order, Parasita.		
Hæmatopinus macrocephalus.	'Horse-louse.'	Horse.
Hæmatopinus eurysternus.	'Sucking ox louse.'	Cattle.
Hæmatopinus eurysternus ani et vulvæ.	'Sucking cow louse.'	Cow (genital parts).
Hæmatopinus vituli...	'Sucking calf louse.'	Calves.
Hæmatopinus stenopis.	'Sucking goat louse.'	Goats.
Trichodectes scalaris.	'Biting ox louse.'	Cattle.
Melophagus ovinus ...	'Ked'—'Sheep louse.'	Sheep.
Order, Diptera.		
Oestrus equi	'Bot' ...	Horse (stomach).
Oestrus bovis ...	'Ox-bot'—'Warble.'	Ox (under the skin.)

LIST OF THE PRINCIPAL ANIMAL AND VEGETABLE PARASITES—*cont*,

Scientific name.	Common name.	Attack.
Oestrus ovis	'Sheep bot'...	Sheep (nostrils).
Tabanus bovinus ...	'Ox gadfly ...	Cattle (sucks blood).
Tabanus autumnalis.	'Horse gad-fly.'	Horse (sucks blood).
Musca vomitoria ... *Musca cadaverina*. *Musca cæsar, etc.* ...	'Maggot flies,' 'blow flies,' 'blue bottle flies,' 'Maggots in wounds.'	Wounds and ulcers in cattle sheep and goats.

Vegetable Parasites.

Scientific name.	Common name.	Attack.
Order, Fungi.		
Achorion schouleinii.	'Tinea favosa.,' honey-comb ring worm.	Skin of ox.
Trichophyton tonsurans bovis.	'Tinea tonsurans,' common ring worm.	Do.
Trichophyton tonsurans equi.	...	Skin of horse.

DAIRYING.

MILK YIELDS OF COWS.

Yield of milk.	Nellore (1).		Aden Banu (2).		Kerry (3).		Cross-bred Bhagiam I (4).		Nellore Raja (5).
	M. MS.	LB.	M. MS.	LB.	M. MS.	LB.	M. MS.	LB.	LB.
First month ...	110	443	77	311	128	515	18	73	465
Second ,, ...	114	459	85	340	159	636	97	391	511
Third ,, ...	106	425	91	365	155	620	107	429	518
Fourth ,, ...	111	445	91	366	138	552	117	470	404
Fifth ,, ...	112	450	94	378	134	536	117	471	161
Sixth ,, ...	115	462	99	399	135	540	121	484	294
Seventh ,, ...	116	464	97	390	136	546	120	481	316
Eighth ,, ...	102	411	97	391	126	506	89	358	283
Ninth ,, ...	70	283	87	348	128	515	86	346	291
Tenth ,, ...	56	226	89	356	114	458	65	261	309
Eleventh ,, ...	40	161	79	319	105	420	38	155	311
Twelfth ,, ...	27	110	54	217	99	396	24	96	283
Thirteenth ,, ...	...	...	61	247	85	340	...	...	271
Fourteenth ,, ...	...	...	55	222	88	354	...	...	269
Fifteenth ,, ...	...	...	...	...	78	315	...	...	256
Extra parts of month ...	...	...	18	72	62	248	3	12	22
Total ...	1,086	4,344	1,181	4,727	1,874	7,498	1,007	4,030	4,964

NOTE.—The first three records are of cows kept at Saidapet: the fourth was a cross-bred Ongole Kerry-Aden cow at Coimbatore and the fifth a Nellore cow, also at Coimbatore.

Analyses.

Cow's Milk.

	Per cent. From	To	Average.
Water	87·5	84·5	86·0
Fat	3·5	6·0	4·5
Proteid	3·1	3·4	3·3
Sugar	4·1	5·1	4·8
Ash	·6	·8	·7

Buffalo's Milk.

	From	To	Average
Water	80·0	85·0	82·4
Fat	5·0	10·0	8·1
Proteid	4·3	4·5	4·3
Sugar	4·2	5·0	4·5
Ash	·7	·8	·7

Goat's Milk.

Water	85·5
Fat	4·0
Other solids	10·5

Cream.

	From	To	Average
Fat	47·6	68·0	57·0

Skim Milk.

Water	90·2
Fat	1·0
Proteid	4·0
Sugar	4·0
Ash...	·8

Butter Milk.

	Per cent. From	To	Average
Water			90·5
Fat			·2
Proteid			3·3
Sugar			5·3
Ash			·7

Butter.

	From	To	Average
Water	12·5	17·0	14·5
Fat	81·0	85·0	84·5
Proteid	·2	·3	·2

Whey.

			Average
Water			92·2
Fat			·3
Other solids			7·5

Colostrum (Cow's).

			Average
Water			75·0
Fat			6·0
Other solids			19·0

Useful Data.

One gallon of milk weighs 10 lb.
One bottle of milk weighs roughly 1 lb. 4 oz.
One Madras measure of milk weighs 4 lb.
One seer of milk weighs 2 lb.

An ollock of milk is 12½ cubic inches, and contains about 8 ounces of milk. Cows are occasionally sold when in milk on the valuation of Rs. 10 for every bottle of milk given per day; i.e., a four-bottle cow will be sold at Rs. 40.

The specific gravity of milk is from 1,028 - 1,032 (water 1,000); that of skimmed milk 1,034—1,037, of cream 985. In testing milk for quality by a specific gravity method, one should be sure that the milk is not adulterated, because the

removal of fat which will increase the specific gravity, may be counterbalanced by the addition of water which will reduce it.

Buffalo's milk is much richer than cows' milk and may contain as much as 10 per cent of butter fat. In estimating the amount of butter to be got from any milk, it will be found approximately equal to the percentage of fat as found by analysis, the loss of fat which occurs in making the butter, being made up by the water contained in the butter. The following table is calculated on this assumption :—

Percentage of butter fat.	Pounds of milk to make one pound butter.	Pounds of milk to make one pound ghee.
10·00	10	15·0
9·09	11	16·5
8·33	12	18·0
7·69	13	19·5
7·14	14	21·0
6·66	15	22·5
6·25	16	24·0
5·88	17	25·5
5·55	18	27·0
5·26	19	28·5
5·00	20	30·0
4·76	21	31·5
4·54	22	33·0
4·35	23	34·5
4·17	24	36·0
4·00	25	37·5

The ghee is taken as 70 per cent of the butter : this is only approximate ; from 70—80 per cent may be obtained.

The percentage of cream obtained from milk will vary according to the quality of the milk and the setting of the Separator. Thus 6—8 lb. of buffalo's milk will give 1 lb. of cream (14 per cent), or 10—12 lb. of cows' milk (9 per cent).

One Madras measure of buffalo's milk should give 10—12 oz. cream and 4—5 oz. of butter.

One viss of ghee (3⅛ lb.) is obtained from 60—70 lb. of buffalo's milk.

100 lb. of cream will yield 30 lb. butter and 70 lb. butter milk. 100 lb. of skim milk will yield 75 lb. curd and 25 lb. whey.

Equipment of the Dairy (for 100 cows).

	Rs.
Separator	200
Churn	85
Delaiteuse (centrifugal drier)	75
Dairy herd recorder	40
Milk filter (Hygeia)	20
Scoops (2)	5
Scotch hands (2)	5
Butter prints (5)	5
Measures (3)	5
Large receiving drums (2)	30
Buckets (5)	35
Hair sieve (2)	3
Scales	20
Furniture	15
Soap, towels, brooms, stationery, baskets, ropes, matches, etc.	30
Total ...	573

For calculating the yield of milk from a herd, the following figures from the herd at Coimbatore may be of use :—

In November 1913, 22 cows in milk gave 124 lb. of milk, i.e., about 5·6 lb. of milk per cow in milk. In addition to these there were 19 cows dry, so that the average yield for the 41 cows is only 3 lb. In March 1914, 22 cows in milk gave 163 lb. daily or an average of 7·4 lb. Adding 18 dry cows, the average for the whole herd of 40 cows was 4·1 lb. The proportion of dry to milking cows is from 39 to 46 per cent.

COMMON INSECT PESTS.

PADDY.

(1) The Stem Borer (*Schœnobius incertellus*) attains the status of a serious pest in some years accounting for a loss of 50 per cent or more of the crop. Usually, however, the damage done is not of much consequence. The caterpillars bore in the stem and cause the formation of dead hearts and dead ears. *Control measures.*—(i) While transplanting weed out and destroy all seedlings showing dead hearts so as to deal with the first brood of the pest. (ii) Wherever possible, plough in the stubble soon after harvest, so as to destroy the resting caterpillars.

(2) Rice Hispa (*Hispa aenescens*), a small black spiny beetle, damaging the young paddy crop. The grubs hatch from eggs laid in the tips of the leaves and mine into them, causing them to turn white and wither. They pupate in the attacked leaves and emerge as beetles after about ten days. The beetles can be captured in hundreds by using a handnet and destroyed. Where eggs have already been laid, the whitened tips of the paddy plants may be cut off with a sickle and burnt, to prevent a further multlplication of the pest.

(3) The Rice Bug (*Leptocorisa*), an elongate greenish insect which appears in hundreds on earheads of paddy in the milky stage and causes a considerable loss of yield. *Remedies.*—The bugs can be easily captured by using handnets and the crops saved thereby.

(4) Swarming Caterpillars.—(i) *Spodoptera mauritia* (the armyworm) occurs in nurseries and in young paddy and may destroy whole areas. Flooding, isolation by trenches, and sweeping are recommended as remedies.

(ii) *Cirphis albistigma* (the Earhead Worm) attacks the ripening earheads and causes a great amount of shedding. In both cases the outbreak is rather sporadic. Isolation of attacked fields by trenching all round them is imperative to prevent the spread of the pest. In the case of Spodoptera flooding the fields is indicated wherever water is available, so as to drown and destroy the pest.

(5) Rice Case Worm (*Nymphula depunctalis*) is a caterpillar that lives inside a case made of bits of rolled-up paddy blades. It may do serious damage to young paddy. Draining the water off the fields for a time, where possible, is a simple remedy since water is essential for its existence.

When draining the fields is impossible, the case worms can be shaken off the plants by drawing thorny branches over the crop and floating a thin film of kerosene on the water whereby they will be destroyed.

(6) Rice Grasshopper (*Hieroglyphus banian*) is a large greenish grasshopper which is capable of causing much damage to paddy. It is found throughout South India, but is specially numerous on the west coast and in the Ganjām District. *Control.*—It can be checked by bagging and destroying the young hoppers on the grasses of field bunds, when they hatch out after the first heavy rains from eggs laid in the soil in the previous season.

SORGHUM.

(1) The Moth Borers (*Chilo simplex* and *Sesamia inferens*) whose caterpillars bore into the shools and stem of the plant, occur in all areas and form one of the chief pests of the crop. They may, when abundant, lead to serious and widespread reduction of the yield. Remedies indicated are: (i) removal and destruction of all plants showing withering shoots, and (ii) disposal of the stubble and dry stalks during the winter.

(2) The Cholam Earhead Bug (*Calocoris angustatus*), occurs throughout the presidency and often proves a very destructive pest especially in the Deccan districts. It attacks the tender flower heads as well as grains in the milk stage, and consequently grain may not form at all, or may be very much undersized. Remedies are under investigation.

(3) Mites causing the whole crop to turn red. They can be checked by dusting with finely powdered sulphur.

(4) The Deccan Grasshopper (*Colemania sphenarioides*), a greenish wingless grasshopper found in Bellary and Kurnool Districts capable of causing serious damage to cereals. They hatch after the first rains from eggs laid in the soil during the previous season.

Control.—(1) Bagging the young hoppers on the young crops from June to August.

(2) Ploughing the fields, where practicable, to destroy the eggmasses.

PENNISETUM TYPHOIDEUM, CUMBU OR SAZZA.

Hairy caterpillars (*Amsacta albistriga* and *A. moorei*) attack the crop regularly in South Arcot and various other parts of South India. The pest rests in the soil at a depth

of 3 to 5 inches as a pupa from September to June of the following year and emerges as a moth after the fall of soaking rains in June, July or August. Each female moth may lay nearly 1,000 eggs. The best way of controlling the pest is to keep a watch for the emergence of moths and handpick them. This pest attacks also various other dry crops such as groundnut, pulses and cotton.

SUGARCANE.

(1) Stemborers of various kinds are important pests especially in the young crop. All dead hearts should be watched for and cut out and burnt immediately

(2) Mealy Wing Scales (*Aleurodes*) are of importance usually only in rattoon crops. They suck the juices of the leaves, leading to weak plants and very inferior juice. Remedy : spray with Fish oil rosin soap.

(3) White Ants (*Termites*) are often very destructive to setts and young plants. Soak the setts in a solution of Crude oil emulsion or Tar emulsion before planting. Treat young plants with the above solutions by means of a watering-can before irrigation.

GROUNDNUT.

(1) "Surul-puchi" (*Stomopteryx subsecivella, sell*).—The groundnut leaf miner—is a very important pest. It is usually kept down by parasites. Light traps can be used with advantage but further investigations are needed.

(2) Ver-puchi—the Root Borer (*Sphenotera sp.*).—Often leads to considerable loss by causing the death of attacked plants. Pull out all attacked plants and destroy them.

(3) Hairy caterpillars—See under *Pennisetum*.

COTTON.

(1) The Spotted Bollworm (*Earias spp.*) attacks the top shoots of young plants and afterwards bores into the bolls. All top shoots seen to wither should be removed and destroyed, as also the bolls found to be attacked later on. Removal of the plants from the fields immediately after harvest and the uprooting of various malvaceous weeds in the neighbourhood will serve to keep the increase of the pest in check.

(2) The Pink Bollworm (*Platyedra gossypiella*) is another borer in bolls capable of increasing far more rapidly than the spotted one. The application of the Pest Act in the

Southern Districts has proved beneficial in checking its increase.

(3) The Cotton Stem Weevil (*Pempheres affinis*) bores in the stems of cotton in the Southern districts of the Presidency and causes the death of the young plants. In older plants a gall is formed at the base of the stem at which point they are liable to snap in a strong wind. Eradication and destruction of plants, as soon as picking is over, will keep down its numbers.

TOBACCO.

(1) The Tobacco Caterpillar (*Prodenia*) does damage especially in the nurseries and may be picked off by hand. In bad cases, spraying with lead arsenate can be advantageously undertaken.

(2) Tobacco Aphis or Plant Lice damage the plants by sucking their juices. It can be checked by spraying with tobacco decoction.

AGATHI.

(1) The Shoot Weevil (*Alcides*) attacks the shoots and causes galls to form in young plants. It can be checked by careful handpicking in the early stages.

(2) The Tobacco Carterpillar (*Prodenia*).--See above under Tobacco. It is capable of doing much damage in the young crop.

MANGO.

(1) The Mango Beetle (*Batocera*) bores tbe branches and the stem as a large grub. Wherever possible it should be cut out and tbe cut portion tarred over. Injection of carbon-bi-sulphide into the burrows may be done, especially in the case of large stems.

(2) The Mang ohopper (*Idiocerus*) is often a serious pest preventing the inflorescences from setting. It can be checked by spraying the affected flowers with Fish oil rosin soap at the right time.

(3) The Fruit Fly (*Dacus*).—The fruits are damaged by its maggots. All attacked and fallen fruits must be scrupulously collected and destroyed. The flies can be destroyed by spraying poisoned molasses.

Pomegranate.

The Pomegranate Butterfly (*Virachola*).—The caterpillars of this blue butterfly bores into the fruits and causes much damage. Attacked fruits should be collected and destroyed. In the case of valuable varieties young fruits may be screened by bagging.

Palms.

Most of the palms—especially the Coconut and the Palmyra—are subject to the attacks of the Rhinoceros Beetle (*Oryctes rhinoceros*) and Red Weevil (*Rhynchophorus*). The former bores into the crown and the latter may lay eggs in holes made by the former. The grubs of the weevil bore into the crown and eventually kill the tree, after which the rhinoceros beetle lays eggs and breeds in the decaying stem. Old dead stumps should be dug out and burnt and all accumulations of organic refuse should be avoided in the gardens as the grubs of the beetle breed in such situations. The weevil also lays eggs in coconut stems badly affected by the Bleeding disease.

Formula for grasshopper baits—

Rice bran or wheat bran ...	1 lb.
Paris green or arsenic... ...	1 oz.
Plantain fruits	6 (to be cut into bits).

Add enough water to make the mixture damp, then add a teaspoonful of salt.

Scatter the baits broadcast in small lumps over the field to be protected—preferably in the evening.

Fish oil rosin soap.—As a contact poison for plant lice: Proportions for spraying: Mix at the rate of 1 lb. in 10 gallons of water.

Lead arsenate.—As a stomach poison for caterpillars, etc.

Paste form.—Mix in water at the rate of 1 oz. in 1 gallon water, taking care to mix it thoroughly in a small quantity of water before diluting to the strength recommended.

Powder form.—At ½ to ¾ oz. in 1 gallon of water, after taking similar precautions.

Tobacco decoction.—Soak 1 lb. of tobacco refuse over night in 1 gallon of water or boil it for half an hour; strain and add ¼ lb. of any soft bar soap cut into thin shavings, beating them till dissolved. Add 4 to 5 parts of cold water before use.

May be used for all plant lice (*Aphids*).

SOME COMMON FUNGUS DISEASES OF CROPS IN SOUTH INDIA.

CEREALS.

1. Cholam.

(*a*) Short smut: *Cintractia sorghi-Vulgaris* Tul. (Clinton).
Tamil: Kariputtainovu.
Telugu: Katiga-tegulu.
A serious disease of cholam occurring wherever it is grown. Very many grains in an earhead are converted into dirty grey-coloured sacs filled with a black powder—the seeds of the fungus.
Control measures: Steeping seed in 2 per cent copper sulphate solution before sowing for 15 to 30 minutes.

(*b*) Long smut: *Tolyposporium filiferum* Busse.
Tamil: Periya Kariputtai novu.
Telugu: Pedda Katiga-tegulu.
Resembles short smut, but fewer grains are affected and spore-sacs are longer and somewhat curved. Does not cause much damage.

(*c*) Leaf-shredding disease: *Sclerospora graminicola* (Sacc.) Schroet Var. *Andropogonis sorghi* Kulk.
Tamil: Talai novu.
Telugu: Verri tegulu.
Leaves are shredded. Earheads are either not formed or grains do not set.
Control measures: Pull out and destroy the infected plants.

2. Cumbu.

(*a*) Smut: *Tolyposporium Penicillariae* Bref.
Tamil: Kariputtai.
Telugu: Katiga tegulu.
Locality: Occurs throughout the Presidency.
A few grains in a head develop into oval greenish spore-sacs about twice the size of healthy grains, and are filled with a snuff-coloured powder.

(*b*) Green-ear disease. *Sclerospora graminicola* (Sacc.) Schroet.
Tamil : Veri noi.
Telugu : Verri kanki.
The flowers instead of developing grains are converted into green leafy structures.
Control measures : Destroy infected plants.

3. Ragi.

(*a*) Leaf-blight : *Helminthosporium nodulosum* Berk. and Curt.
A seasonal disease and not a common one. Deep brown elongated spots appear on leaves, leaf-sheaths and stem.

(*b*) Blast : *Piricularia sp.*
Tamil : Kolli novu.
Telugu : Aggi tegulu.
Locality : Kistna, Vizagapatam, North Arcot, Coimbatore and North Malabar.
Grey spots with a brown margin appear on leaves and leaf-sheaths. Nodes and neck of the earheads blacken. When the neck of the earhead is affected grains are not properly developed. A sporadic disease.

4. Tenai.

Smut : *Ustilago Crameri* Koern.
Tamil : Kariputtai noi.
Telugu : Katiga tegulu.
Locality : Ceded Districts.
Instead of grains in the earhead little bags of black powder are seen.
Control measures : Steeping seeds in 2 per cent copper sulphate solution for 15 to 30 minutes before sowing.

5. Wheat.

Rust : *Puccinia graminis* Pers.
Tamil : Sembai noi.
Telugu : Pasupa tegulu.
Locality : Coimbatore.
Small yellow spots afterwards turning into elongated black patches appear on leaf and leaf sheath.

6. Paddy.

(*a*) False smut : *Ustilaginoidea virens* Cke (Tak.)
Tamil : Nelpazham.
Telugu : Varipandu.
Malayalam : Lakshmi.
Locality : South Kanara, Gōdāvari, Tanjore, Chittoor and other tracts.
Only a few grains are affected. Large velvety greenish masses about twice the size of normal grains appear between the glumes. Occurs only when there is bumper crop and there is little damage done.

(*b*) Blast : *Piricularia oryzae* Cav.
Tamil : Kollinovu.
Telugu : Aggi tegulu
Locality : Tanjore, North Arcot, Coimbatore, North Malabar and Kurnool.
Brown spots with grey centres occur on leaves and leaf-sheaths, nodes and neck of the earhead get blackened. When the neck of the ears is affected, grains do not develop. A seasonal disease.

(*c*) Blight : *Helminthosporium oryzae* Miy.
Locality : Kistna, Gōdāvari and Coimbatore.
Small elongated brown spots appear on leaves, leaf-sheaths, etc. Some glumes are also affected and the grains do not develop well. A seasonal disease; occurs in years of heavy unseasonal rains.

(*d*) Ephelis : *Ephelis oryzae* Syd.
Tamil : Nel-Kariputtai.
Telugu : Katiga tegulu.
Locality : Coimbatore, Coorg and other districts.
The earhead instead of having loose panicles is converted into a straight thick-set spike with undeveloped grains. Not known to cause serious loss.

PULSES.

Bengal gram.

Wilt: *Rhizoctonia* sp.
Locality : Coimbatore.
Leaves suddenly droop and dry up; small black sclerotia appear on affected roots.

ROOT CROPS AND OIL SEEDS.

1. Potato.

(*a*) Early blight : *Alternaria Solani* (E & M) Jones and Grout.
Locality : Ootacamund.
Isolated pale brown spots scattered irregularly and showing concentric narrow dark lines appear on leaves which curl and drop off.
Control measures :--Spraying with Bordeaux mixture.

(*b*) Scab.
Locality : Ootacamund.
Rough raised outgrowths on the surface of the tubers.
Control measures : Selection of seeds and treatment with corrosive sublimate solution (1 gram in 1,000 c.c.) for half an hour.

(*c*) Ring disease : *Bacillus solanacearum* Smith.
Locality : Ootacamund and the Shevaroys.
Causes sudden wilting of plants. Tubers when cut show a brown ring a little way below the rind.
Control measures : Selection of seed and rotation of crops.

2. Groundnut.

Tikka-leaf spot : *Septogloeum Arachidis* Rac.
Locality : Coimbatore, Salem and South Arcot.
Dark spots surrounded by a bright yellow ring appear in large numbers on leaves which consequently drop.

DYE, DRUG AND SPICE CROPS.

1. Tobacco.

(*a*) Mildew : *Erysiphe Cichoracearum* DC.
Tamil : Sambal noi.
Locality : Coimbatore.
A very common disease causing severe loss of crop. A whitish web becoming powdery occurs chiefly on the upper surface of leaves.
Control measures : Plant sanitation such as wide spacing to secure proper aeration, avoidance of shade, attention to drainage and prompt removal of the infected leaves.

(*b*) Leaf spot : *Cercospora Nicotianae* Ell. and Ever.
Locality : Coimbatore.
A disease of very wide occurrence, which disfigures the leaves and renders them unmarketable. Small brown spots gradually becoming white in the centre appear on leaves.
Control measures : Wide planting and early removal of lower leaves.

2. Turmeric.

Leaf-spot : *Vermicularia Curcumae* Syd.
Tamil : Pulli or Poriyan noi. Telugu : Lambadi tegulu.
Locality : Kistna, Gādōvari and Coimbatore.
Brown, irregular patches with black dots in concentric rings in the centre appear enclosed by yellowish margin. Rhizomes do not develop properly.
Control measures : Spraying with Bordeaux mixture in the early stages.

3. Ginger.

(*a*) Soft-rot : *Pythium Butleri* sub.
Locality : North Malabar.
Yellowing and withering up of leaves and rotting of rhizomes.
Control measures : Destroyal of rotten rhizomes and selection of seed rhizomes from disease-free localities and rotation of crops.
(*b*) Leaf-spot : *Vermicularia Zingiberae* Sund.
Locality : Gōdāvari and North Malabar.
Yellowish brown spots with greyish centre appear on leaves.
Rhizomes do not develop properly.
Control measures : Spraying with Bordeaux mixture

4. Chillies.

Fruit-rot : *Vermicularia Capsici* Syd.
Tamil : Melagai Azhugal noi. Telugu : Moripa Kullu tegulu.
Fruits turn yellow and rot and sunken spots with black dots arranged in concentric circles are formed. The fruits lose their pungency and become useless.
Control measures : Spraying with Bordeaux mixture.

FIBRE CROPS.

1. Cotton.

(*a*) Sore-shin : *Rhizoctonia solani* kuehn.
A disease of great importance in all cotton-growing countries. Sudden withering and dropping of leaves rotting of roots and yellowing of stem. The bark shreds at the base and minute black dots are seen on the roots.
Control measures : Systematic destroyal of affected plants.

(*b*) Black leg disease : *Bacterium*. Stem flattening—brownish discolouration of stem—wilting and breaking at the affected portion.

PALMS.

1. Palmyra.

Bud-rot : *Phytophthora palmivora* Butl.
Telugu : Movvu kullu.
A very serious disease of this palm causing much damage in the Northern Circars. The central shoot yellows and dries up and the other leaves drop one by one. The bud rots and the tree dies.
Control measures :: Cutting and burning of the diseased crown is the only possible remedy.

.2. Coconut.

(*a*) Bud-rot : *Phytophthora palmivora* Butl.
Locality : Malabar and Gōdāvari.
Same as above.

(*b*) Mahali : *Phytophthora omnivora* Var. *arecae* Coleman.
Locality : Malabar.
Greyish white patches appear on fruits. The fruits rot and drop down from the bunches.
Control measures : Spraying with Bordeaux mixture

(*c*) Stem-bleeding disease : *Thielaviopsis paradoxa*.
Tamil : Sar ozhugal novu : Telugu : Lakka tegulu.
Malayalam : Raktha kari roga.
Locality : Travancore, North Arcot, Madura, Salem South Kanara and Cochin.
Yellowish brown patches on the bark formed by exudation of reddish-brown liquid from the cracks of the stem.

Control measures : Chiselling of affected portions and application of hot tar to the exposed surface.

3. Arecanut.

Mahali : *Phytophthora Omnivora* Var. *arecae* Coleman.
Locality : South Kanara, Cochin and Malabar.
A disease causing much damage in all arecanut gardens.
Greyish white patches appear on the fruits. The fruits rot and drop down from the bunches.
Control measures. : Spraying with Bordeaux mixture.

SUGAR-CANE.

(a) Redrot. *Colletotrichum falcatum* Went.
Tamil : Sembulli-pulippu noi.
Locality : A widely distributed disease.
On splitting a cane a sour smell may be noticed and the tissues are reddened. Definite red patches with a trans- versely elongated white centre are present.
Control measures. : Selection of healthy setts.

(b) Smut : *Ustilago sacchari* Rabenh.
Another serious disease of the crop. The central shoot gets converted into a long whip-like dusty black structure.
Control measures : Prompt removal of the affected shoots and burning them.

FRUIT-CROPS.

1. Mango.

Sooty mould : *Capnodium mangiferae* E. cy. Br.
Locality : Malabar, Coimbatore, Trichinopoly and Kistna.
A dense black sooty crust appears particularly on the upper surface of the leaves.
Control measures : As the fungus follows in the wake of certain insects, treatment should be done to get rid of the insects.

2. Orange.

(a) Die-back : *Colletotrichum gloeosporioides* Penz.
Locality : Coimbatore, Tinnevelly and Kistna.

A widely spread disease. Drying up of the twigs from the top presenting the appearance of the branching horns of a stag and showing black dot-like pustules on the bark.

Control measures: Pruning of affected portions and spraying with Bordeaux mixture.

3. Grape-vine.

(*a*) Mildew. *Oidium Tuckeri* Berk.

Tamil: Sambal noi.

Locality: Coimbatore, Salem and Madura.

An important disease of the crop causing severe loss. A grey powdery growth on leaves and fruits which crack, rot and become useless.

Control measures: Spraying with Bordeaux mixture.

(*b*) Anthracnose. *Gloeosporium ampedophagum* (Pass.) Sacc.

A disease of less importance. Brown, slightly sunken patches with raised borders resembling the eye of a pigeon occur in all green parts especially on fruits causing them to rot.

Control measures: Spraying with Bordeaux mixture.

Fungicides.

1. *For treating seeds.* *2 per cent copper sulphate solution.*

To secure 2 per cent strength of solution one has to dissolve a tola of copper sulphate in a bottle of water. A kerosine bottle ordinarily available in the bazaar can be taken as a measure for water, and a rupee as the weight for one tola of copper sulphate.

2. *For spraying growing parts of plants as stem, leaves and fruits.*

Bordeaux.

Bordeaux mixture is a preparation of copper sulphate and quicklime in water. It may be used strong or weak. The strength generally regarded as a standard is :—

Copper sulphate	5 lb.
Quicklime	5 lb.
Water	50 gallons.

A mixture of this strength is known as the 5—5—50 formula.

The quantity to be made at one time is a matter of convenience, depending on the number of plants to be sprayed and on the available vessels.

Fifty gallons is often a convenient quantity to make at a time; for this, one 50-gallon barrel and two 25-gallon tubs are required. The method of preparation is always the same whatever the quantity of mixture required—

(1) Wrap 5 lb. of copper sulphate in a piece of gunny bag, powder it on a stone, tie up the piece of gunny and suspend it by a string to a stick laid across the mouth of a tub containing 25 gallons of water. In a short time the copper sulphate will have dissolved.

(2) Put 5 lb. of good quicklime in a tub, and sprinkle about a quarter of a gallon of water on it. When the lime begins to crack and crumble add more water a little at a time, taking care that the lime does not become too dry. Keep on adding water, a little at a time, till a thick creamy paste free from lumps is formed. Add the requisite quantity of water to make up to 25 gallons. Stir well.

(3) While stirring vigorously, slowly pour the solution of copper sulphate and the milk of lime together into the large barrel. Keep stirring for two or three minutes.

Properly prepared mixture is of a light sky blue colour.

When using Bordeaux mixture during the monsoon, an adhesive substance must be added to prevent the mixture being washed off by the rain. An efficient adhesive may be prepared from resin and washing soda. For the above quantity of 50 gallons Bordeaux mixture put 2 lb. washing soda in an earthenware pot containing 2 gallons of water and bring to the boil. Add 4 lb. of powdered resin, a little at a time. For the first half hour the liquid is liable to boil over, so the fire should be a slow one, as the liquid becomes clear the fire may be made to burn more brightly. The liquid should be boiled altogether an hour. It becomes clear like coffee decoction. While stirring vigorously slowly add the resin-soda liquid to the Bordeaux mixture.

Test.—Rub the blade of a knife in sand or earth till it is polished, then dip in the mixture for a minute. If the blade is unchanged the mixture is safe. But if the blade becomes red, then more lime must be added, till the clean blade is not stained when dipped afresh in the mixture.

HORTICULTURE.

	Number of trees per acre
2 feet each way	10,890
3 " "	4,840
4 " "	2,722
5 " "	1,742
6 " "	1,210
8 " "	680
10 " "	435
12 " "	302
15 " "	200
18 " "	135
20 " "	110
25 " "	70
30 " "	50
35 " "	35
40 " "	27

HEDGE PLANTS.

Hedges are used for guarding against trespass, providing lateral shade and for ornament. Almost any plant can be used for one or other of these purposes, but attention here is chiefly directed to such hedges as are agriculturally useful. For gardens there are a very great number of hedge plants in India and all stages can be obtained between creepers on trellises on the one hand and rows of all shrubs and borders for ornamental beds.

1. *Pithecolobium dulce*—
   Korukapili—Tamil.
   Simachintha—Telugu.

This is a leguminous plant well suited for hedges as it stands any amount of cutting back. Seeds must be sown in 2 or 3 rows. When the plants are about 2 feet high, they must be topped to make them branch, and during each year they must be cut back at least twice. Gaps in old hedges may be filled up by half cutting through tall branches and laying them down across the gaps.

2. *Opuntia Dillenii*—The prickly-pear.
   Sappaththi Mullu—Tamil.
   Nagadali—Telugu.

An excellent hedge, impenetrable and easily made, with one disadvantage that it takes up rather a lot of room. It leaves the land on which it grows enriched, however, and crops can be grown right up close to it. It is propagated by simply laying cut pieces on the ground.

3. *Balsamodendron Berryi* *—
Mullukiluvai—Tamil.

It is possible to get a good hedge by planting cut branches just before the commencement of rains (June or July). To keep the hedge in good condition it must be cut back occasionally.

4. *Euphorbia Tirucalli*—The milk hedge.
Tirugukalli—Tamil.

A small tree with round stem and smooth cylindrical branches. Useful as a hedge plant because cattle will not approach it as the milky juice or latex is acrid and irritating. It causes acute pain if it gets into the eyes. Easily propagated by cuttings.

5. *Euphorbia Antiquorum*—
Chadurakkalli—Tamil.

This is also often used as a hedge plant and is raised from cuttings.

6. *Casuarina equisetifolia*—
Savukkumaram—Tamil.
Chavukku Manu—Telugu.

These plants form a very handsome hedge as may be seen on the Marina, Madras Beach, if constantly pruned and trimmed. Casuarina must be raised from seeds.

7. *Arundo donax*—very often forms a thick impenetrable hedge, generally seen round betel gardens. It is planted from stumps.

8. *Saccharum arundinaceum*—
Pekkarumbu—Tamil.
Verricheruku—Telugu.

This is also a common hedge plant round betel gardens. Propagated from stumps.

9. *Sesbania grandiflora*—
Agaththi—Tamil.
Avisi—Telugu.

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* See page 42.

10. *Sesbania egyptiaca*—
Siththagaththi or karunsembai--Tamil.

These plants are sometimes used in betel gardens to form a hedge. Both are raised from seeds.

11. *Poinciana elata.*—By planting stumps a good hedge may be formed. But the shoots must be constantly trimmed or it will become thin below.

12. *Lawsonia alba*—Henna.
Maruthani-- Tamil.
Gorantaku—Telugu.

By sowing seeds or by planting cuttings a hedge may be formed. As with others this must be constantly cut back.

13. *Acacia farnesiana*—
Pee Velan—Tamil.
Kamputumma--Telugu.

and

14. *Acacia arabica—Babul.*
Karuvelan—Tamil.
Nallatumma—Telugu.

Both these Acacias are capable of being used for hedges. They must be raised by sowing seeds and cut back at intervals.

15. *Agave americana and other agaves.*
Kaththalai—Tamil.

Agave plants may be propagated from suckers. These plants form a fine hedge after some time. Little or no attention is required after planting.

16. *Borassus flabellifer*—The Palmyra palm.
Panai—Tamil.
Thadi—Telugu.

The Palmyra palm can be propagated only by seeds. By sowing the seeds in rows these may be made to grow so as to form a hedge. As they grow very slowly, they form a good hedge for a considerable period of time.

17. *Thevetia neriifolia*—Exile oleander.
Lingarali—Tamil.

A shrub or a small tree often grown in gardens as a hedge. The plant is easily raised from seed and attains a height of about 15 feet, but the growth is checked by frequent pruning.

18. *Tecoma stans*—
Tangarali; Sornapatti—Tamil.

A large shrub or a small tree with pretty yellow flowers, often met with in gardens. Thick hedges may be obtained by sowing seed very close, but they will be very thin below unless the branches are frequently cut.

19. *Tamarindus indical*—The tamarind.
Pulian—Tamil.
Chintachettu—Telugu.

A very common tree which needs no description. Seeds are closely sown for purposes of making hedges. Though the growth is slow the hedge becomes very thick and impenetrable in a few years, and stands for a long time. The height can be regulated by trimming.

20. *Caesalpinia pulcherrima*—The peacock flower.
Mayil konnai—Tamil.

A large garden shrub with a few prickles, bearing pretty large, yellow or red flowers. Plants are raised from seed and make a tolerably good hedge if properly pruned.

21. *Caesalpinia crista*—
Gajja kai—Tamil.
Gechcha kai—Telugu.

A large climbing shrub easily spreading and armed with hooked and straight spines. It is well suited for hedges where space is not of much consideration. Propagation is by means of seeds. A few plants will form an impenetrable barrier in a few years.

22, *Punica Granatum*—Pomegranate.
Madalam—Tamil.
Danimma—Telugu.

By close planting of cuttings a pretty good hedge may be formed. But the branches have to be frequently trimmed.

23. *Bignonia megapotamica.*

An introduced tree commonly met with in gardens, and having many spreading branches. Seeds have to be sown a few inches apart and when the plants are 3 to 4 ft. high they may be cut back from time to time.

24. *Carissa Carandas*—
Kalakkai—Tamil.
Vakkai, Kalavi—Telugu.

This can be used as a hedge plant on account of its shrubby and armed nature. Plants are raised from seed.

25. *Leucaena glauca*—
Tagarai chedi—Tamil.
Gilang—Telugu.

A leguminous plant suitable for making hedges. The branches are pruned to regulate the height of the hedge. Propagation is by means of seeds and cuttings.

26. *Jatropha Curcas*—
Kattamanaku, Vellamanaku—Tamil.
Adavi amudam, Nepalam—Telugu.

A milky shrub often met with as a hedge plant in villages.

It is easily raised from seed or cuttings.

27. *Jatropha gossypifolia*—
Seemai Kattamanaku—Tamil.
Seama Nepalam—Telugu.

It is sometimes grown as a hedge plant in sandy soils especially those bordering streams. When once raised from seed or cuttings little or no attention need be paid to it.

28. *Adhatoda Vasica*—
Adhatoda—Tamil.
Addasaram—Telugu.

A common hedge plant in the Vizagapatam District. A fairly good hedge is made by planting cuttings a few inches apart. It is also much prized in Hindu medicine.

29. *Pedilanthus tithymaloides*—
Kannadi kalli—Tamil.

A hardy perennial easily grown from cuttings. The growth is rather slow and branching is sparse. To make a tolerably good hedge the cuttings must be planted very close. When established the plant requires no care and stands any amount of pruning.

Coconut Gardens

East Coast.

Thoroughly ripe nuts from trees that have passed the middle age are carefully collected and dried in the shade for about a fortnight. These nuts are then arranged one touching the

other in a seed-bed with the butt-ends above, covered with sand, and irrigated every day. The nuts begin to germinate after about two months, all finish sprouting after 5 or 6 months. When the seedlings are about 3 feet high or 6 to 8 months old, they are lifted and permanently transplanted in all the southern districts. In the northern districts these are transplanted 7 feet apart in a second seed-bed, and 3 or 4 years after, these are again lifted and transplanted permanently in a field at the rate of 50 or 60 per acre. In the south as many as 150 per acre are planted. The trees begin to bear 8 to 10 years from the date of planting the nuts, but the full bearing is to be expected after 12 years. On an average about 50 or 60 nuts can be expected from each tree, and the trees bear for about 100 years provided proper care is taken. In the south, tapping coconut trees is very common, but in the north it is entirely absent. Root pruning and careful manuring are the secrets of successful coconut cultivation. In the southern districts, coconut topes are irrigated, but in the north a surface mulch of fine soil is provided by ploughing immediately after the rains.

West Coast.

Ripe nuts are carefully gathered from the middle-aged trees in February-March, germinated and planted out after six months to three years, in February-March or June-July, according as the land is low or high lying. Sixty trees per acre is a fair number, but even double the number is not uncommon in certain parts.

Sandy loams are the best. Along sea-coast and river banks they flourish very well. The yield per tree varies from 10 to 100 nuts. The trees may live long, 75 years or more; generally begin to bear fruit in about 12 years increasing in yield up to 60. It has been observed along salt water river banks that the trees begin to bear in about 5 years, but die an earlier death.

They require plenty of sun and water, and respond to heavy manuring. They are opened out in June-July and manured with green leaves and ashes. This operation facilitates percolation of water and formation and development of young roots.

There is nothing else in the West Coast to be compared to this tree in point of yield and usefulness, every bit of it being of great economical value. It is therefore rightly called

"Kalpaka Vriksha," i.e., the tree that gives all the requirements of man.

Areca Nuts.

Ripe nuts are gathered from old trees and seedlings are raised from them. When about six months old, they are transplanted, generally in June-July. Loamy soils at the bottom of a valley, cool and moist, are the best fitted. They grow straight and tall, begin to bear in about 10 years and may live over 80 years, the yield becoming less and less after middle age. They give three to six bunches, varying from 50 to 200 nuts each, even more in favourable localities if properly watered and heavily manured. A rupee per tree is not an exaggerated figure. The nuts are prepared and largely exported from the West Coast. They are used for chewing with chunam and betel leaves, with or without tobacco. They are valuable as a medicine. The stem is much used for house construction.

Mango Gardens.

The number of plants to the acre varies with the soil. On rich soils where the trees spread well, 20 to 25 are planted, while on gravelly soils where the growth is rather stunted, up to 50 trees to the acre. The best distance is 40 feet apart, in rows 30 feet apart, the plants arranged quincuncially, whereby 36 go to the acre. Grafts are not allowed to bear for the first three or four years to promote growth. Afterwards an average yield of about Rs. 2 to 3 may be expected from each tree. The value of the fruit varies considerably with the variety. There are varieties that fetch up to Rs. 4 a dozen. The gardens can be considerably improved by interculturing and growing a pulse crop like horsegram. Graft mango gardens bear well for about 50 years when they must be renewed.

Jack Gardens.

The Jack is a tree, which requires plenty of rainfall, and moist and dewy climate : it is rare in parts of the East Coast where the conditions are adverse, but is quite a common tree in the West Coast bearing very heavily in the dewy, cold and mountainous interior villages.

It is always planted mixed with coconut, arecanut, mango and pepper, serving as a standard for the last-mentioned

creeper. Its top shade is very heavy and highly objectionable to the neighbouring trees. When alone, 20 trees will be ample per acre. Seedlings are raised from well-chosen nuts from young trees, and they (4 to 6 months old) are planted out in well prepared and protected pits at the close of the South-West Monsoon rains. They should be watered when necessary.

Red loams with an admixture of gravel are preferred. The trees grow slowly, begin to bear in about 12 years, live long, even over 100 years: flower in December-January; harvest is completed in June-July. They are seldom manured, but the garden receives one or two diggings a year. The yield per tree varies considerably from 5 to 200 fruits (worth 5 annas to 5 rupees) with age, soil and locality. It is a poor man's food on the West Coast. There are two main varieties, hard and soft, known as Varikai and Pazhom. The wood is one of the best in the world in point of hardness and polish, with golden yellow colour. It is excellent for all kinds of woodwork, particularly for furniture.

Plantain Gardens.

[This note refers to the practice which prevails in the Cauvery valley.]

The land is leased for three years: pits are dug about 7½ feet apart, and in the month of October, 750 suckers to the acre are planted. Drains are dug between every alternate row in both directions, dividing the land up to into a number of beds. After one month, the field is dug over thoroughly some six times, i.e., every alternate month. Fencing has to be attended to, and manure—generally a mixture of cattle manure and tannery refuse—is applied four months after planting. The trenches are deepened, and irrigation attended to, and the removal of side suckers from May onward, and the earthing up of the trees is carried out.

Bunches appear in October and November, twelve to thirteen months after planting, and are collected until February. Meanwhile, only one new sucker has been left and the land is dug over, but only twice during the second year, in February and June: manure is given after the first digging. The second crop is obtained from October to February. Towards the end, suckers are not removed, the object now aimed at being to get plenty of leaves which are eventually cut and sold in June, when the whole crop is removed. A crop of paddy is taken before the land is handed back to the lessor.

CASUARINA TOPES.

Usually poor sandy soils of upland tracts are put under casuarina cultivation. Ripe fruits from old trees are gathered in the hot weather, put in earthen pots and kept in the sun. The fruits burst and the seeds are then carefully dried and stored. Twelve ounces of seed sown on 100 square feet will supply seedlings sufficient to transplant one acre. The seed is sprinkled evenly on the surface of the nursery and covered thinly with ashes and cattle manure. The plot is then covered with straw, leaves, etc., and regularly watered. The seeds sprout in 8 to 10 days. Care should be taken to keep weeds and ants from the nursery. After three months, the seedlings should be transplanted in another nursery and they are finally removed for planting in the field in 6 or 8 months, i.e., when they are less than 3 feet high. 3,000 to 4,000 small pits are dug with mamuty in an acre 3 feet to 4½feet apart, kept exposed for a time, and then hand watered just before planting. The pits are not manured. The plants should be watered almost daily till they take root, and then they can be watered once a week during the first year, or in exceptional cases, for two hot weather seasons. The plantation should be thinned and all crooked plants removed, leaving 1,500 plants to the acre. The trees will be ready for cutting in 10 years, and will fetch about Rs. 750 to 1,000 per acre at 8 annas per tree. In the intervening years the proceeds from the loppings of the side branches, etc., will defray all expenses such as hand-watering, etc. After the plantation is cut, about 50 per cent of the roots will put forth fresh shoots, and when the dead roots are dug out, a groundnut crop may be raised in the interspace. The ratoon plantation will also be ready for cutting in 10 years.

BATAVIAN ORANGE GARDENS (CIRCARS).

Seeds are collected from ripe fruit of fairly aged trees, mixed with ashes and dried in the shade for about a week, These are then planted in a seed-bed about an inch apart. When the seedlings are about 6 inches high, they are lifted and transplanted in a second nursery about 6 inches apart. Here they are kept for 3 years or even more. Seedlings about 3 years old are available at Rs. 50 per 100. These are transplanted 15 to 16 feet apart, or 150 or 200 plants to the acre depending on the nature of the soil. Plantains are also planted to give shade to the young transplants. The trees

begin to bear seven years after permanent transplanting. A mixture of red earth and sheep manure is considered to be a very good manure. On the borders of the gardens, limes, pumelos, citrons are always planted. Along the water channels very good pineapples are also grown. On an average each tree gives about 200 fruits worth about Rs. 5, in the garden itself. The garden gives full produce for about 20 years.

Babul Topes.

Land intended for babul topes may be either sown, or trees may be allowed to spring up naturally from seed passed by sheep or goats which have browsed over the land. The seed possesses a hard coat which unless scratched or pounded in some way may interfere with germination. No further treatment of the land is necessary, and the plantation may be left to itself. The rate of growth depends upon the soil and the tope may be mature in anything from 10 to 20 years, i.e., be of a size sufficient to afford marketable timber. The grazing under babul is generally good, and the pods themselves are a valuable and nutritious food.

Bamboo Topes.

[This note embodies the practice at Ayyampet, Tanjore District.]

The seeds are sown in the nursery in July-August. One Madras measure of seed, which cost from Re. 1 to Rs. 5, is sown in one cent divided into 25 beds. Seeds keep their vitality only for one year. Seeds germinate in six or seven days. Until then the nursery is shaded. Beds are watered once a day for a week and are kept free from weeds. About four months after sowing, i.e., in December-January, the seedlings are removed and planted in bunches of four plants at 8 inches apart. *Agathi grandiflora* or *Sesbania ăculeata* is sown here and there for shade. In this condition the seedlings remain for about two years. Afterwards they are removed and planted in *padugai* lands (in pits) in bunches containing from four to ten tillers at 8 feet apart. While planting the plants are topped from 4 feet to 2½ feet high. Seedlings in 100 kulis or 33 cents are sold for Rs. 200. These are sufficient for planting 4⅓ acres. There is a class of Muhammadans (Ravuttars) who grow seedlings for sale and have made this their business. No manure is applied to bamboos and no other particular operation is given except

pruning from the third or fourth year. The cost of pruning will be realized by the sale of loppings, besides getting the area fenced round. The bamboos will be fit for cutting from about the fifth year after the final planting or about seven and a half years from the date of sowing the seed. In some places they are cut when they are about ten years old. The cutting is done in alternate years and the value of the yield amounts to Rs. 400 or 500 every other year or from Rs. 200 to 250 per acre annually. The bamboos are sorted into four classes according to different sizes:—

I Class	...	...	Rs. 40	per 100.
II "	...	...	" 30	"
III "	...	...	" 20	"
IV "	...	...	" 10	"
Mother branches		...	" 2	"

It is said that bamboos flower once in sixty years, when they all die. Some say that they flower in thirty years.

Pruning.

The proper pruning of trees is often much neglected and the loss in timber, foliage and fruit thereby caused is very considerable. The matter receives very careful attention among horticulturists in temperate climates, but it is rendered difficult in India because of the rapid growth and the absence of any true resting period, when pruning usually takes place. Stated briefly, the object of pruning a tree is to give it a good natural shape, whereby all its branches, leaves and flowers have free space to grow, and incidentally, to increase the number of these. An ideal form must be aimed at in each tree, but, as the natural habit of trees varies very much,. this will differ with the species. Compare for instance the cork tree (*Millingtonia suberosa*) of erect, narrow habit and the low flat-crowned gold mohur with the well-rounded tamarind. All three of these must be treated in entirely different ways, to obtain the maximum of leaf surface. Seeing that trees are so constantly cut for fuel, fodder and leaf-manure in South India, a recognition of the general principles of pruning is very important.

Pruning for fruit is little understood in India. Two of the commonest methods adopted for increasing fruitfulness are root-pruning and shoot-pruning, and one example has been chosen among Indian fruit trees to show that the right method can only be arrived at after a careful study of the natural habit of the plant. The guava is a small tree or large

shrub of very variable shape, but the flowers and fruits are borne in very well defined places. A little study will show that, when a new shoot appears, the second, third and fourth pairs of leaves usually bear flowers in their axils, and that these are produced nowhere else. If then a tree has become unfruitful numerous new shoots must be produced. Some grafted Chinese guavas in the Botanic garden at Coimbatore, had not borne fruit after three years' growth, and two of them were taken for experiment. In the first, a deep trench was dug around and all the roots were cut across ; a severe pruning of all its branches was given to the second. The result was very instructive. The root-pruned plant dropped many of its leaves but produced no new shoots and therefore no flowers. The shoot-pruned plant was covered with bursting buds within a week of the operation. Many of these bore flowers in the usual place and after six months, there were nearly a hundred fruits upon it.

SOME COMMON TIMBER TREES.

1. Grewia tillefolia, Vahl.

Vernacular.—Sadachi. Thadasu, Unu, Tam.* ; Thadasu. Mal. ; Thadasal, Kan. ; Thana, Thadda, Tel. ; Dhomono, Oriya.

Habitat.—Throughout the Presidency, ascending to 4,000 feet.

Description.—A moderate sized deciduous tree. Wood brown, hard, tough, and elastic. Takes a good polish. Weight about 40 lb.*

Chief uses.—Boats, masts, oars, ploughs, shoulder poles, tool-handles, house posts, door and window frames, furniture, carts (all parts), excellent for cooper's work. Has some of the properties of American hickory.

By-products.—Fibre extracted from the bark.

2. Azadirachta Indica, Juss. (Melia indica, Brandis)

The Margosa or Nim.

Vernacular.—Veppam, Vembu, Tam ; Veppu, Mal ; Betta Bevan, Kan. ; Yepa, Veppa, Tel. ; Limbo, Oriya.

Habitat.—Natural in the dry forests of the Carnatic and Deccan but widely planted especially as an avenue tree.

Description.—A moderate to large sized deciduous tree. Heartwood red, hard, close-grained, scented, resembling mahogany, durable. Weight about 50 lb.

Chief uses.—House building (all parts except planking) furniture, carts, axles, yokes, naves and felloes, ship and boat building, oars, ploughs and oil mills.

By products.—Bark yields a febrifuge, seeds expressed for oil, all parts medicinal.

3. Cedrela Toona, Roxb.

The Red cedar.

Vernacular.—Santhana-Vembu, Agil, Tam.; Vembu Vella-Agil, Mal. ; Noga, Kan. ; Mahalimbo, Oriya.

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* Note.—The weights of wood given are per cubic foot dry. The abbreviations of Vernacular names used are as follows :—

Tam.	Tamil.
Mal.	Malayalam.
Kan.	Kanarese.
Tel.	Telugu.

Habitat.—Western Ghats and low hills of Southern India.

Description.—A large deciduous tree, wood brick red and soft but even-grained, fragrant and easily worked, seasons readily, does not split or warp when seasoned. Durable and not attacked by white ants. Weight 30 to 35 lb.

Chief uses.—House building (chiefly planking and panels), excellent for furniture and boxes, well-construction, dug-outs, and canoes, oars, yokes and carving.

4. Chloroxylon swietenia, DC.

The Satin wood.

Vernacular.—Karum-porasu, Tam.; Huragalu, Kan.; Billudu, Tel.; Bheru, Oriya.

Habitat.—Dry forests and low hills of Southern India, not in areas of heavy rainfall.

Description.—A moderate sized deciduous tree. Wood light-yellow, hard, close-grained with a satiny lustre. Very durable. Weight 60 lb.

Chief uses.—Much exported to Europe for furniture and cabinet work. Bridge work, wharf-piles, ploughs, agricultural implements, oil-mills, pestles, carving and turning, carts (all parts), boats, tool handles, gunstocks, high-class panelling.

5. Mangifera indica, Linn.

The Mango.

Vernacular.—Ma-maram, Tam.; Mava, Mal., Mava, Kan.; Mamidi, Tel.; Ambo, Oriya.

Habitat.—Indigenous along the Western Ghats, but extensively cultivated everywhere.

Description.—A large evergreen tree. Wood grey, in old trees sometimes dark brown, soft. Weight 42 lb.

Chief uses.—Planking, door and window frames, packing cases, tea boxes, cheap furniture, dug-outs, well-construction, ploughs, yokes, felloes and cooper's work.

6. Dalbergia latifolia, Roxb.

The Blackwood or Rosewood.

Vernacular.—Iti, Tam.; Iti, Mal.; Biti, Kan.; Jittegi, Tel.; Siasua, Oriya.

Habitat.—Throughout the Madras Presidency up to 4,000 feet.

Description.—A large deciduous tree. Heartwood dark purple with black streaks, very strong and durable, seasons well without warping or splitting and takes polish well. A very fine timber. Weight about 55 lb.

Chief uses.—High class furniture, carts (all parts), ploughs, well-construction, tool-handles, walking-sticks and cooper's work.

7. Pterocarpus marsupium, Roxb.

The Kino tree.

Vernacular.—Venge, Tam.; Venge, Mal.; Honne, Kan.; Yegi, Yegise, Tel.; Piasal, Oriya.

Habitat.—Throughout the Madras Presidency except in wet evergreen forests, up to 4,000 feet.

Description.—A large deciduous tree. Heartwood yellowish-brown with darker streaks, very hard, durable, seasons well and takes a fine polish. The heartwood stains yellow when damp. Weight about 55 lb.

Chief uses.—Posts, beams, door and window frames, furniture, agricultural implements, carts (all parts), boat-building, cars, cooper's work.

By-products.—Yields gum kino.

8. Hardwickia binata, Roxb.

Vernacular.—Acha, Tam.; Kamra, Kan.; Yepi, Tel.

Habitat.—Dry forests of Southern India, up to 3,000 feet.

Description.—A large deciduous tree. Heartwood dark-red or purplish, streaked with black, extremely hard, close and cross-grained, very durable, does not warp, but apt to split. Weight about 82 lb.

Chief uses.—House and bridge posts, beams and rafters, carts (all parts), ploughs, clod-crushers, vessels for sowing seeds, hand-looms, well-construction, carving, turning and ornamental work, bearings for machinery and oars.

By-products.—The bark yields a useful fibre.

9. Tamarindus indica, Linn.

The Tamarind.

Vernacular.—Puli, Tam.; Puli, Mal.; Hunase, Kan.; Chinta, Tel.; Koya, Tentuli, Oriya.

Habitat.—Doubtfully indigenous in India, but everywhere grown.

Description.—A large evergreen tree, sapwood yellowish-white, sometimes with red streaks, heartwood small, present only in old trees, very durable and difficult to work. Weight, sapwood 62 lb., heartwood 80 lb.

Chief uses.—Oil and sugar-mills, rice-pounders, mortars, pestles, ploughs, mallets, tool-handles, furniture, house fittings, well-construction, cooper's work, tent-pegs, side planks of boats, carts, shafts, axles and naves.

10. Xylia dolabriformis, Benth.

Ironwood.

Vernacular.—Irul, Tam.; Irul, Mal.; Jambe, Kan.; Kondatangedu, Tel.; Tangani, Oriya.

Habitat.—Eastern and Western Ghats in semi-moist forests.

Description.—A large deciduous tree, remaining small on poor soils, heartwood reddish-brown, extremely hard, cross-grained, very durable. Weight 60 lb.

Chief uses.—House building (chiefly posts, beams and scantlings) bridge-construction, piles, telegraph posts, sleepers, railway waggon construction, tent-pegs, railway keys, well-construction, boats, dug-outs, carts (all parts), ploughs, harrow-teeth, yokes, oil-presses, shingles, tool-handles.

11. Acacia arabica, Willd.

The Babul tree.

Vernacular.—Karu-velam, Tam.; Karu-velam, Mal.; Jali Kan.; Nalla-tumma, Tel.; Babulo, Oriya.

Habitat.—Probably not indigenous in Southern India, but abundantly cultivated and self-sown in tank-beds, on bunds, along channels and other similar situations where there is alluvial soil and water not far from the surface.

Description.—A moderate sized tree, heartwood pink turning reddish-brown on exposure, mottled with dark streaks, hard, very durable. Weight 54 lb.

Chief uses.—House buildings (posts, beams, rafters, door and window frames), carts (all parts), solid wheels, boat-building, oars, sugar and oil-presses, rice-pounders, ploughs harrows, clod-crushers, Persian wheels, well curbs, tool-handles, cooper's work, carving and turning, the best wood for tent pegs. Excellent fuels.

By-products.—Bark yields tannin and a dye, the pods are used as fodder, the resin yields a fair gum.

12. Albizzia lebbek, Benth.

The Indian Walnut.

Vernacular.—Vage, Sele-unjal, Tam.; Vage, Vel-vage. Mal.; Bengha, Bage, Kan.; Dirisanam, Girisanam, Tel.; Sirisa, Oriya.

Habitat—Throughout Southern India in the drier parts often planted.

Description.—A large deciduous tree. Heartwood dark-brown streaked with lighter or darker streaks, hard, fairly durable, seasons, works and polishes well. Weight 47 to 50 lb.

Chief uses.—A handsome furniture wood, house building (chiefly posts and beams), ploughs, rollers, oil-mills, sugarcane crushers, yokes, well-curbs, boats, carts (all parts), cooper's work and turnery.

13. Terminalia tomentosa, W. & A.

Vernacular.—Karumarudu, Tam.; Karimaridu, Mal.; Karimadi, Kan.; Nellamaddi, Tel.; Sahajo, Oriya.

Habitat.—Throughout the Presidency up to 4,000 feet but not in evergreen forests.

Description.—A large deciduous tree. Heartwood dark-brown with streaks of dark colour, hard and apt to split in seasoning. Weight 67 lb.

Chief uses.—House building (all parts), rough furniture, oil-mills, rice-pounders, ploughs, harrows, yokes, shafts and axles of carts, boat and ship-building.

By products.—Bark is used for tanning and dyeing, especially fishing nets.

14. Anogeissus latifolia, Wall.

Vernacular.—Velnage, Vekkali, Tam.; Vella-naga, Mal.; Dinduga, Kan.; Chiruman, Tel.; Dhau, Oriya.

Habitat.—Dry deciduous forests throughout the Presidency up to 5,000 feet.

Description.—A large deciduous tree, often stunted at the higher elevations, sapwood grey, hard, shining, smooth, Heartwood small and irregular, purplish-brown, very hard, very tough, but splits in seasoning. Weight 62 lb.

Chief uses.—Poles and rafters, axles and shafts of carts yokes, naves, ploughs and other agricultural implements, rice pounders, mortars, tool-handles, tent pegs, spinning-wheels, shoulder poles, furniture, boat building and mine props.

15. Eugenia jambolana, Lam.

The Black Plum.

Vernacular.—Naga, Naval, Tam.; Navil, Mal.; Nerale, Kan.; Naredu, Tel.; Jambo, Oriya.

Habitat.—Throughout the Presidency up to 6,000 feet, chiefly along streams, often cultivated.

Description.—A large evergreen tree, Wood reddish-grey, moderately hard, fairly durable, lasts well under water. No distinct heartwood. Weight 48 lb.

Chief uses.—House building (chiefly posts, beams and rafters), carts (all parts), boat-building, oars, masts, agricultural implements, rice-mortars, well curbs, common furniture, carving and turning.

By-products.—The fruit is edible.

16. Adina cordifolia, Hook.

Vernacular.—Manjakadambe, Tam.; Manjakadamba, Mal.; Kadamba, Kan.; Rudrabataganapu, Tel.; Holondo, Oriya.

Habitat.—Deciduous forests throughout the Presidency up to about 3,000 feet.

Description.—A large deciduous tree. Wood yellowish, moderately hard, even-grained, seasons well, but apt to warp and crack. No heartwood. Weight 45 lb.

Chief uses.—Building (posts but chiefly planking), dug-outs, packing cases, light furniture, agricultural implements yokes, shingles, carving and turning.

17. Tectona grandis, Linn. f.

The Teak tree.

Vernacular.—Tekku, Tam.; Tekku, Mal.; Tega, Kan.; Teku, Tel.; Saguvani, Oriya.

Habitat.—Hilly tracts of Gōdāvari, Kurnool, Cuddapah, Mysore, Coorg, Malabar, the Nilgiris, Coimbatore, Madura, Tinnevelly, Travancore and Cochin.

Description.—A large deciduous tree. Wood dark-golden, yellow when fresh, turning dark-brown with age, hard and very durable, rarely attacked by white ants, probably due to the large amount of oil it contains. Does not warp or crack One of the finest known timbers. Weight 45 lb.

Chief uses.—House building (all parts), bridge-work, ship-building, furniture, ploughs, yokes, harrows, carts (all parts), railway sleepers, railway carriages, casks, well-construction looms, spinning wheels, etc.

18. Ficus bengalensis, Linn.

The Banyan tree.

Vernacular.—Ala, Tam.; Peria-ala, Mal.; Ala, Goli, Kan.; Marri, Tel.; Bori, Oriya.

Habitat.—Probably not indigenous in the Madras Presidency, but widely planted especially as an avenue tree.

Description.—A large shady tree, throwing down numerous ærial roots from the branches. Wood grey, moderately hard, not durable but lasts well under water. Wood of the ærial roots stronger than that of branches. Weight 36 lb.

Chief uses.—Door panels, boxes, cheap furniture, well crubs, pestles, the wood of the ærial roots is used for tent-poles, cart-yokes, and shafts and shoulder poles.

19. Artocarpus integrifolia, Linn. f.

The Jack tree.

Vernacular.—Pilla, Tam.; Pilavu, Mal.; Alasu, Kan.; Panasa, Tel.; Ponaso, Oriya.

Habitat.—Indigenous in the forests of the Western Ghats up to 4,000 feet, much cultivated elsewhere.

Description.—A large evergreen tree. Heartwood bright yellow, darkening on exposure. Moderately hard. Weight 40 lb.

Chief uses.—House building, boats, masts, oars, carts (yokes, naves spokes and felloes), rice-pounders, cooper's work, well-construction, furniture, boxes and turnery.

By-products.—Yields the well-known jack fruit.

20. Borassus flabellifer, Linn.

The Palmyra Palm or Toddy Palm.

Vernacular.—Pane, Tam.; Pana, Mal.; Pani, Talimara, Kan.; Tadi, Tel.; Talo, Oriya.

Habitat.—Not indigenous in India, but cultivated and run wild throughout the Madras Presidency.

Description.—A large erect palm. Wood light-brown and soft inside, outside black and handsomely streaked, hard, strong, very durable under water.

Chief uses.—Posts and rafters, water-pipes and gutters, troughs, dug-outs, well-construction, turnery and buckets.

By-products.—The sap is tapped for toddy and jaggery. The leaves are used for thatch, umbrellas, mats, fans, hats, sandals, buckets, basket work, writing tablets, etc. The pulp of the fruit is edible. The fibres are used for brushes

South Arcot	2,693,098	1,327,150	1,506,065	2·40	3·02
Chittoor	3,590,316	694,375	800,818	3·56	1·98
North Arcot	3,170,935	1,155,284	1,320,568	2·82	2·42
Salem	4,423,916	1,586,830	1,806,238	5·35	4·02
Coimbatore	4,628,128	1,908,443	2,158,258	8·27	4·17
Trichinopoly	2,815,822	1,279,774	1,383,726	3·83	3·37
Tanjore	2,386,320	1,351,958	1,458,243	3·25	2·91
Madura	3,155,652	1,220,168	1,393,025	3·87	3·29
Rāmnād	2,314,578	1,131,302	1,191,107	3·61	4·85
Tinnevelly	2,788,317	1,169,759	1,393,774	3·98	4·00
Malabar	3,706,725	1,433,925	1,712,718	6·07	3·84
South Kanara	2,573,509	543,308	743,237	7·40	1·51
The Nilgiris	632,830	78,580	82,705	13·03	8·20
Total for the Presidency.	90,577,219	33,263,040	37,367,132	...	...

Statement showing the average rainfall of the districts of the Madras Presidency.

District.		South-west monsoon (June to September).	North-east monsoon (October to December).	Dry weather (January to March).	Hot weather (April and May).	Total.
Ganjām ...	Agency.	43·1	7·5	2·2	6·2	59·0
	Plains.	28·8	11·0	1·7	3·6	45·1
Vizagapatam	Agency.	47·3	5·7	1·4	5·1	59·5
	Plains.	24·4	10·4	1·5	3·7	40·0
East Gōdāvari	Agency.	36·1	7·4	1·4	4·1	49·0
	Plains.	24·6	12·2	0·9	2·6	40·3
West Gōdāvari ...	...	26·4	9·9	0·7	2·3	39·3
Kistna ...	...	24·1	9·6	1·1	2·2	37·0
Guntūr ...	...	18·7	10·3	1·0	2·1	32·1
Kurnool ...	...	17·3	5·9	0·6	1·9	25·7
Bellary ...	...	14·6	5·6	0·4	2·6	23·2
Anantapur...	...	13·4	6·3	0·4	2·6	22·7
Cuddapah ...	...	15·4	10·1	0·7	2·0	28·2
Nellore ...	...	11·3	20·5	1·5	1·7	35·0
Chingleput ...	...	15·8	27·0	1·8	1·9	46·5
South Arcot ...	...	16·6	24·8	1·9	2·7	46·0
Chittoor ...	...	15·0	14·1	1·4	3·0	33·5
North Arcot ...	...	18·0	14·8	1·4	3·5	37·7
Salem ...	...	14·8	11·2	1·2	5·5	32·7
Coimbatore ...	...	8·4	11·7	1·4	5·1	26·6
Trichinopoly ...	...	12·1	15·2	1·6	4·9	33·8
Tanjore ...	...	12·4	27·1	2·3	3·1	44·9
Madura ...	...	9·0	15·3	2·0	5·1	31·4
Rāmnād ...	...	7·3	17·3	2·4	3·7	30·7
Tinnevelly ...	...	3·3	18·7	3·9	3·1	29·0
Malabar ...	...	88·4	17·2	1·3	11·0	117·9
South Kanara ...	...	125·5	12·6	0·3	7·1	145·5
The Nilgiris ...	...	42·1	19·5	3·6	8·9	74·1

STATEMENT SHOWING THE HARVEST PRICES OF FOOD GRAINS PER IMPERIAL MAUND OF $82\frac{2}{7}$ LB. DURING THE AGRICULTURAL YEAR 1926–27.

Group.	District.	Rice (second sort).		Cholam.		Cumbu.		Ragi.	
		RS.	A.	RS.	A.	RS.	A.	RS.	A.
Circars ...	Ganjām	6	8	...		...		3	14
	Vizagapatam ...	6	13	...		4	5	4	0
	East Gōdāvari ...	7	0	4	3	...		3	11
	West Gōdāvari ...	6	14	5	3	...		4	0
	Kistna	7	6	5	0	...		4	0
	Guntūr	7	2	4	6	4	11	...	
Deccan ...	Kurnool	7	6	3	11	4	13	...	
	Bellary	8	0	4	8	...		...	
	Anantapur ...	7	5	4	0	3	13	3	5
	Cuddapah ...	7	13	4	0	3	5	4	11
Carnatic ..	Nellore	7	0	4	10	5	0	4	3
	Chingleput ...	7	5	...		...		5	0
	South Arcot ...	7	11	...		5	2	4	14
Central ...	Chittoor	7	2	...		3	11	3	8
	North Arcot ...	7	6	...		4	14	4	13
	Salem	8	5	5	2	4	8	4	6
	Coimbatore ...	8	0	5	5	5	0	5	5
	Trichinopoly ...	8	3	5	2	5	5	5	0
South ...	Tanjore	7	0	...		...		4	14
	Madura	7	5	5	2	5	11	4	13
	Rāmnād	8	0	4	8	5	10	4	2
	Tinnevelly ...	7	2	4	3	5	13	4	6
West Coast.	Malabar	7	0	...		...		...	
	South Kanara ...	6	11	...		...		..	
Hills ...	The Nilgiris ...	8	0	...		...		5	10

STATEMENT SHOWING THE AVERAGE YIELD (POUNDS PER ACRE) OF PRINCIPAL CROPS IN EACH DISTRICT OF THE MADRAS PRESIDENCY.

District.	Paddy.		Cholam.		Cumbu.		Ragi.		Kora.
	Irri-gated.	Unirri-gated.	Irri-gated.	Unirri-gated.	Irri-gated.	Unirri-gated.	Irri-gated.	Unirri-gated.	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ganjām	1,300	800	1,200	700	1,200	650	1,100	700	600
Vizagapatam ...	1,400	800	1,300	700	1,200	700	1,200	700	600
East Gōdāvari ...	2,000	900	1,300	700	1,200	630	1,200	800	700
West Gōdāvari...	2,000	1,000	1,300	700	1,200	630	1,300	800	700
Kistna	1,800	1,000	1,300	700	1,200	630	1,600	800	700
Guntūr	1,800	1,100	1,300	630	1,200	630	1,900	800	600
Kurnool ...	1,600	1,000	1,400	630	1,200	550	1,600	650	350
Bellary	1,700	900	1,500	450	1,300	450	1,000	450	350
Anantapur ...	1,700	800	1,400	450	1,200	400	1,550	600	350
Cuddapah ...	1,800	900	1,500	630	1,300	700	1,650	600	400
Nellore	1,550	1,100	1,300	600	1,300	700	1,650	600	700
Chingleput ...	1,550	1,100	1,400	600	1,000	650	1,100	600	800
South Arcot ...	1,850	1,100	1,500	600	1,000	700	1,500	800	1,000
Chittoor... ...	1,900	1,000	1,500	600	1,000	650	1,800	700	600
North Arcot ...	1,900	1,100	1,500	600	1,200	650	1,550	800	900

Salem	1,900	800	1,500	600	1,300	600	1,550	750	700
Coimbatore ...	1,900	800	1,500	600	1,200	400	1,700	800	700
Trichinopoly ...	1,900	1,000	1,500	500	1,200	500	1,400	650	700
Tanjore... ...	1,750	1,100	1,300	500	1,200	700	1,100	500	700
Madura	1,950	900	1,400	600	1,000	450	1,400	650	600
Rāmnād... ...	1,800	1,100	1,400	400	1,000	400	1,500	400	600
Tinnevelly ...	2,000	1,000	1,500	350	1,000	450	1,600	500	500
Malabar	...	1,400	...	700	...	600	...	1,500	600
South Kanara ...	...	1,500	...	...	...	...	...	1,000	...
The Nilgiris ...	...	1,800	...	500	...	450	...	1,000	700
Normal yield per acre ...	1,747	1,155	1,453	575	1,201	547	1,479	706	403
	1,578		672		612		1,041		

Statement showing the average yield (pounds per acre) of principal crops in each District of the Madras Presidency—*cont.*

District.	Varagu.	Samai.	Maize.	Sugarcane.	Gingelly.	Castor.	Cotton.		Tobacco.
							Irrigated.	Unirrigated.	
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Ganjām	700	500	1,000	5,000	280	250	...	50	1,000
Vizagapatam ...	700	500	1,000	6,500	336	250	...	50	1,000
East Gōdavāri ...	800	600	1,000	7,500	336	250	...	75	1,300
West Gōdāvari...	800	600	1,000	7,500	336	250	...	75	1,300
Kistna	800	600	1,100	7,500	336	250	...	75	1,300
Guntūr	700	500	1,100	7,500	280	250	...	75	1,300
Kurnool... ...	500	400	1,000	4,500	224	150	...	50	1,000
Bellary	500	400	1,000	6,000	224	150	...	50	1,000
Anantapur ...	500	400	1,000	4,300	224	150	...	50	1,000
Cuddapah ...	600	400	1,000	6,000	224	150	...	50	1,000
Nellore	600	400	1,000	6,000	280	250	...	75	1,300
Chingleput ...	800	500	1,000	6,000	280	250	250	50	1,000
South Arcot ...	1,300	500	1,000	6,500	280	250	250	65	1,000
Chittoor... ...	700	500	1,000	7,300	280	250	250	65	1,000
North Arcot ...	1,000	500	1,000	6,000	280	250	250	50	1,000

14

Salem	600	400	1,000	6,000	280	400	250	54	1,200
Coimbatore ...	600	400	1,000	7,500	280	400	250	71	1,200
Trichinopoly ...	1,000	500	1,000	5,000	336	400	250	58	1,200
Tanjore	1,000	500	1,000	6,000	336	400	250	65	1,200
Madura	900	500	1,000	6,000	280	400	250	107	1,200
Rāmnād ...	900	500	1,000	4,500	280	400	250	109	1,200
Tinnevelly ..	900	400	1,000	4,500	280	400	250	108	1,200
Malabar ...	...	400	1,000	6,000	224	400	...	50	1,200
South Kanara ...	...	500	1,000	5,400	280	400	...	50	1,200
The Nilgiris ...	700	600	1,000	6,000	280	400	...	50	1,200
Normal yield per acre ...	875	449	1,059	6,383	303	229	250	71	1,165
							84		

NOTE.—(1) The normal yield per acre is 500 lb. for Bengalgram, 200 lb. for horsegram, 1,120 lb. for groundnut, and 28 lb. for indigo.

(2) Figures of normal yield of lint per acre for each variety of cotton in the southern half of the Presidency are :—irrigated cambodia 250 lb. ; irrigated karunganni in Coimbatore 150 lb. ; dry cambodia 80 lb. in Salem, Coimbatore and Trichinopoly, 100 lb. in Madura, Rāmnād and Tinnevelly, and 50 lb. elsewhere ; uppam 65 lb. ; dry karunganni in Coimbatore 85 lb. ; nadam and bourbon 20 lb., and Tinnevellies 110 lb.

Statement showing the area sown with crops in 1926–27.

District. (1)	Paddy. (2)	Cholam. (3)	Cumbu. (4)	Ragi. (5)
	ACS.	ACS.	ACS.	ACS.
Ganjām	1,151,604	14,032	11,835	195,390
Vizagapatam ...	1,155,383	77,439	190,965	493,457
Gōdāvari, East.	635,397	101,163	35,423	28,228
Do. West.	681,300	73,553	8,845	6,152
Kistna	538,376	243,620	35,702	5,981
Guntūr	399,926	355,044	248,095	22,491
Kurnool ...	57,827	653,182	74,078	18,963
Bellary	28,130	781,952	117,510	29,456
Anantapur ...	82,714	297,116	171,657	98,825
Cuddapah ...	94,231	279,769	124,131	60,968
Nellore	349,974	383,909	105,046	80,447
Chingleput ...	637 525	8,533	14,237	86,062
South Arcot ...	539,319	61,956	86,847	101,470
Chittoor ...	167,640	26,419	163,749	132,459
North Arcot ...	377,312	45,421	110,582	120,150
Salem	93,047	158,251	431,974	283,157
Coimbatore ...	101.255	433,231	457,321	173,355
Trichinopoly ...	250,066	210,046	289,492	31,421
Tanjore ...	1,102,996	15,093	6,565	31,059
Madura	312,247	238,156	71,591	80,534
Rāmnād ...	286,019	106,263	136,191	85,643
Tinnevelly ...	330,013	127,936	187,822	35,081
Malabar ...	883,905	291	...	12,284
South Kanara ...	579,362	...	...	6,527
The Nilgiris ...	6,118	100	26	3,173
Grand total ...	10,841,686	4,692,475	3,079,684	2,272,733

Statement showing the area sown with crops in 1926-27—*cont.*

District.	Korra. (6)	Varagu. (7)	Samai. (8)	Maize. (9)
	ACS.	ACS.	ACS.	ACS.
Ganjām	5,115	2,994	23,446	7,500
Vizagapatam ...	17,426	8,402	147,561	15,039
Gōdāvari, East.	5,012	5,648	7,480	3,676
Do. West.	1,049	2,206	1,421	1,304
Kistna	3,613	4,544	34	25,339
Guntūr	81,472	5,887	4	32,342
Kurnool ...	349,634	83,915	14,795	163
Bellary	479,937	1,464	17,618	50
Anantapur ...	274,301	52,476	107,378	177
Cuddapah ...	84,928	26,379	3,001	1
Nellore	25,459	76,240	1,735	88
Chingleput ...	1,174	32,690	42	11
South Arcot ...	9,081	192,607	2,855	...
Chittoor ...	7,372	26,442	13,316	33
North Arcot ...	1,453	91,238	39,537	1,919
Salem	24,596	80,647	149,466	8,274
Coimbatore ...	26,571	8,327	85,124	14
Trichinopoly ...	1,041	190,213	29,031	9,203
Tanjore ...	119	69,086	584	383
Madura	8,938	87,140	120,477	4,636
Rāmnād ...	343	106,591	15,133	1,184
Tinnevelly ...	328	13,112	39,443	39
Malabar ...	18	...	17,118	44
South Kanara ...	...	...	190	...
The Nilgiris ...	216	16	4,000	...
Grand total ...	1,409,196	1,168,264	840,789	111,419

Statement showing the area sown with crops in 1926–27—*cont.*

District.	Other cereals. (10)	Total cereals. (11)	Green-gram. (12)	Red-gram. (13)
	ACS.	ACS.	ACS.	ACS.
Ganjām	5,136	1,417,052	133,184	15,699
Vizagapatam ...	74,582	2,180,254	58,154	19,426
Gōdāvari, East ...	3,920	825,947	43,874	5,782
Do. West ...	1	775,831	2,456	4,254
Kistna	7,173	864,382	25,370	3,733
Guntūr	259,722	1,404,983	12,072	23.936
Kurnool	23,864	1,276,421	3,624	16,782
Bellary	6,934	1,463,051	16,212	32,459
Anantapur ...	2,414	1,087,058	1,850	15,241
Cuddapah ...	12,873	686,281	944	293
Nellore	41,282	1,064,180	18,522	2,653
Chingleput ...	483	780,757	434	179
South Arcot ...	6,647	1,000,782	543	2,195
Chittoor	357	537,787	666	1,452
North Arcot ...	1,733	789,345	1,060	12,651
Salem	14,888	1,244,300	8,066	17,166
Coimbatore ...	734	1,285,932	5,222	8,705
Trichinopoly ...	1,878	1,062,391	1,128	16,628
Tanjore	448	1,226,333	495	7,250
Madura	41,018	964,737	500	3,233
Rāmnād	78,183	815,550	1,873	2,804
Tinnevelly ...	40,564	774,338	10,537	4,235
Malabar	...	913,660	4,738	1,327
South Kanara ...	...	586,079	8,139	...
The Nilgiris ...	9,175	22,824	...	...
Grand total ...	634,009	25,050,255	359,663	213,083

STATISTICS.

TABLE SHOWING THE AGRICULTURAL POSITION OF THE DISTRICTS OF THE MADRAS PRESIDENCY DURING THE AGRICULTURAL YEAR, 1926–27.

Districts.	Total area.	Area under cultivation.	Area actually cropped.	Average size of holding.	Area cultivated by a pair of cattle.
	ACS.	ACS.	ACS.	ACS.	ACS.
Ganjām	5,364,818	1,508,402	1,817,336	3·88	3·68
Vizagapatam	10,999,240	2,622,656	3,066,852	6·19	2·92
East Gōdāvari	4,582,445	994,746	1,261,372	6·51	2·80
West Gōdāvari	1,504,993	742,191	949,955	5·94	3·08
Kistna	2,016,692	1,049,219	1,177,880	5·87	3·92
Guntūr	3,683,824	1,967,806	2,221,383	4·97	6·66
Kurnool	4,825,849	2,050,189	2,079,470	8·25	10·46
Bellary	3,649,806	2,401,363	2,427,212	12·57	10·70
Anantapur	4,272,980	2,024,581	2,080,696	10·63	7·37
Cuddapah	3,724,695	1,059,876	1,130,806	4·11	5·84
Nellore	5,087,200	1,191,108	1,294,615	7·14	3·74
Chingleput	1,965,897	770,047	909,073	3·46	2·23
Madras	18,634	...	...	.	...

Statement showing the area sown with crops in 1926–27—*cont.*

District.	Black-gram. (14)	Bengal-gram. (15)	Horse-gram. (16)	Other pulses. (17)
	ACS.	ACS.	ACS.	ACS.
Ganjām	20,472	3,103	27,341	6,516
Vizagapatam ...	21,849	1,667	89,123	13,646
Gōdāvari, East ...	30,334	3,380	67,551	6,703
Do. West ...	2,733	1,532	35,591	4,150
Kistna	8,224	2,341	26,562	2,383
Guntūr	424	7,963	14,812	915
Kurnool	2,867	11,702	80,631	4,176
Bellary	3	11,165	82,617	18,855
Anantapur ...	6	7,123	348,275	2,980
Cuddapah ...	182	992	59,615	569
Nellore	1,617	1,526	76,050	2,239
Chingleput ...	3,793	39	7,457	692
South Arcot ...	2,312	1	8,055	2,083
Chittoor	563	28	52,873	674
North Arcot ...	5,120	182	53,962	1,979
Salem	7,765	1,194	236,018	25,616
Coimbatore ...	6,158	2,325	222,471	49,766
Trichinopoly ...	1,274	82	35,684	2,771
Tanjore	3,827	2	1,971	1,843
Madura	5,215	229	94,659	8,532
Rāmnād	7,766	2,721	10,561	3,177
Tinnevelly ...	18,643	870	51,145	16,294
Malabar	4,779	13	6,133	5,963
South Kanara ...	11,492	...	21,787	1,846
The Nilgiris ...	...	...	9	84
Grand total ...	167,418	60,180	1,710,953	184,452

Statement showing the area sown with crops in 1926-27—*cont.*

District.	Total pulses. (18)	Chillies. (19)	Other condiments and spices. (20)	Total condiments and spices. (21)
	ACS.	ACS.	ACS.	ACS.
Ganjām	206,315	2,533	18,925	21,458
Vizagapatam ..	203,865	18,601	35,903	54,504
Gōdāvari, East ...	157,624	24,485	6,031	30,516
Do. West ...	50,716	7,179	2,222	9,401
Kistna	68,613	19,973	3,711	23,684
Guntūr	60,122	130,819	32,725	163,544
Kurnool	119,782	20,190	2,507	22,697
Bellary	161,311	9,081	5,545	14,626
Anantapur ...	375,475	7.750	13,662	21,412
Cuddapah ...	62,595	4,302	8,737	13,039
Nellore	102,607	8,597	3,969	12,566
Chingleput ...	12,594	2,590	795	3,385
South Arcot ...	15,189	1,976	3,506	5,482
Chittoor	56,256	5,505	8,942	14,447
North Arcot ...	74,954	3,356	6,249	9,605
Salem	295,825	6,986	7,425	14,411
Coimbatore ...	294,647	12,418	7,882	20,300
Trichinopoly ...	57,567	7 543	15,295	22,838
Tanjore	15,388	5,792	3,313	9,105
Madura	112,368	8,456	8,826	17,282
R mnād	28,902	9,298	4,027	13,325
Tinnevelly ...	101,724	20,411	8,905	29,316
Malabar	22,953	3,591	106,401	109,992
South Kanara ...	43,264	5,625	9,536	15,161
The Nilgiris ...	93	21	500	521
Grand total ...	2,700,749	347,078	325,539	672,617

Statement showing the area sown with crops in 1926–27—*cont.*

District.	Sugar-cane. (22)	Sugar (others). (23)	Total sugar. (24)	Mango. (25)
	ACS.	ACS.	ACS.	ACS.
Ganjām	4,825	192	5,017	20,865
Vizagapatam ...	35,941	1,139	37,080	46,575
Gōdāvari, East ...	9,799	477	10,276	24,110
Do. West...	1,227	1.058	2,285	7,761
Kistna	110	3,194	3,304	8,651
Guntūr	97	4,308	4,405	2,465
Kurnool ...	500	199	699	3.205
Bellary	7,829	92	7,921	1,927
Anantapur ...	2,520	10,179	12,699	3,941
Cuddapah ...	518	633	1,151	9,052
Nellore	49	2,100	2,149	5,199
Chingleput ...	135	1,402	1,537	3,281
South Arcot ...	7,391	1,290	8,681	1,700
Chittoor ...	10,890	2,055	12,945	22,552
North Arcot ...	4,748	2,013	6,761	16 035
Salem	4,743	649	5,392	3,974
Coimbatore ...	10.322	395	10,717	406
Trichinopoly ...	5 685	332	6,017	2,434
Tanjore	760	2,363	3,123	5,806
Madura	2,136	1,054	3,190	2,501
Rāmnād ...	331	1,293	1,624	807
Tinnevelly ...	197	34,422	34,619	879
Malabar ...	108	12,504	12,612	47,697
South Kanara ...	3,631	362	3,993	2,458
The Nilgiris ...	3	...	3	...
Grand total ...	114,495	83,705	198,200	244,331

Statement showing the area sown with crops in 1926–27—*cont.*

District.	Plaintain. (26)	Other fruits and vegetables including root crops. (27)	Total fruits and vegetables including root crops. (28)	Miscellaneous food-crops. (29)
	ACS.	ACS.	ACS.	ACS.
Ganjām	3,453	13 645	37,963	4,063
Vizagapatam ...	3,559	36,124	86,258	11,172
Gōdāvari, East ...	4 828	11,258	40,196	72
Do. West ..	4,848	9,130	21 739	966
Kistna	185	5 035	13,871	932
Guntūr	614	6 274	9,353	432
Kurnool ...	178	3,878	7,261	...
Bellary	445	3,914	6,286	157
Anantapur ...	46	6 024	10,011	907
Cuddapah ...	160	7,168	16,380	...
Nellore	237	3 846	9,282	103
Chingleput ..	1,516	4,344	9,141	3,957
South Arcot ...	1,255	16,999	19,954	2,110
Chittoor ...	779	4,503	27,834	1,511
North Arcot ...	465	5,713	22,263	935
Salem ...	3,679	2,911	10,564	6,271
Coimbatore ...	2,887	10,555	13,848	200
Trichinopoly ...	9,075	11,912	23,421	124
Tanjore	11,100	11,602	28,508	...
Madura	13,898	11,973	28,372	44
Rāmnād ...	4,767	11,626	17,200	1,178
Tinnevelly ...	5,836	8,147	14,862	786
Malabar ...	48,459	80,489	176,645	13,605
South Kanara ...	2,534	16,233	21,225	..
The Nilgiris ..	560	9,359	9,919	401
Grand total ...	125,363	312,662	682,356	49,626

Statement showing the area sown with crops in 1926–27—*cont.*

District.	Total food-crops. (30)	Ground-nut. (31)	Gingelly. (32)	Castor. (33)
	ACS.	ACS.	ACS.	ACS.
Ganjām	1,691,868	37,017	54,042	4,878
Vizagapatam ...	2.573,133	91,399	132,900	11,872
Gōdāvari, East...	1,064,631	267	70,158	7,845
Do. West ..	860,938	5,181	47,655	11,106
Kistna	974.786	8,503	7,724	14,000
Guntūr	1,642,839	77,694	861	61.665
Kurnool ...	1,426,860	357,853	2,481	44,519
Bellary	1,653,352	180,623	15,548	24,484
Anantapur ...	1,507,562	255,903	29,821	84,890
Cuddapah ...	779,446	251,366	6,581	12,441
Nellore	1,190,887	6,160	4,130	43,017
Chingleput ..	811,371	50,279	14,217	44
South Arcot ...	1,052,198	396,841	25,194	802
Chittoor ...	650,780	108,852	4,401	10,570
North Arcot ..	903,863	363,820	7,436	5,290
Salem	1,576,763	93,787	29,530	18,883
Coimbatore ...	1,625,644	125,676	30,870	9,393
Trichinopoly ...	1,172,358	94.141	45,467	8,773
Tanjore	1,282,457	90 232	23,016	399
Madura	1,125,993	49,784	22,515	7,450
Rāmnād ...	877,779	29,877	28,124	1,848
Tinnevelly ...	955 645	3,481	64,564	815
Malabar ...	1,249,467	1 419	11,876	352
South Kanara ...	669,722	...	2,749	169
The Nilgiris ...	33,461	1	30	13
Grand total ...	29,353.803	2,680,156	681,890	385,023

Statement showing the area with crops in 1926–27—*cont.*

District.	Coconut. (34)	Other oil seeds. (35)	Total oil seeds. (36)	Cotton. (37)
	ACS.	ACS.	ACS.	ACS.
Ganjām ...	9,339	10,680	115,456	1,406
Vizagapatam ...	3,181	95,885	335,237	19,410
Gōdāvari, East...	51,853	529	130,652	9,596
Do. West...	9,735	15	73,692	1,254
Kistna	1,014	279	31,520	41,635
Guntūr	381	563	141,164	108,728
Kurnool	77	8,139	413,069	224,270
Bellary	2,080	14,052	236,787	522,309
Anantapur ...	510	12,500	383,624	175,645
Cuddapah ...	114	584	271,086	57,293
Nellore	456	191	53,954	31,198
Chingleput ...	8,638	701	73,879	33
South Arcot ...	3,370	2,450	428,657	818
Chittoor ...	2,851	8,268	134,942	377
North Arcot ...	10,735	2,053	389,334	1,925
Salem	9,233	1,132	152,565	49,731
Coimbatore ...	7,791	127	173,862	282,614
Trichinopoly ...	6,383	1,430	156,194	47,413
Tanjore	34,623	7,283	155,553	1,033
Madura	6,550	81	86,380	148,674
Rāmnād ...	3,235	629	63,713	206,829
Tinnevelly ...	4,600	112	73,572	270,866
Malabar ...	326,864	420	340,931	435
South Kanara ...	49,202	67	52,187	196
The Nilgiris ...	...	57	101	...
Grand total ...	552,815	168,227	4,468,111	2,203,688

Statement showing the area with crops in 1926–27—*cont.*

District.	Other fibres. (38)	Total fibres. (39)	Indigo. (40)	Other dyes. (41)
	ACS.	ACS.	ACS.	ACS.
Ganjām	3,878	5,284	...	750
Vizagapatam ...	53,194	72,604	213	3,317
Gōdāvari, East ..	25,488	35,084	621	5
Do. West...	2,924	4,178	16	27
Kistna	14,343	55,978	1,930	...
Guntūr	73,065	181,793	1,867	...
Kurnool ...	456	224,726	3,662	...
Bellary	2,587	524,896	58	180
Anantapur ...	1,982	177,607	1,063	...
Cuddapah ...	240	57,533	8,572	...
Nellore	2,579	33,777	8,788	3
Chingleput ...	908	941	2,505	16
South Arcot ...	182	1,000	9,696	...
Chittoor ...	142	519	10,955	1
North Arcot ...	161	2,086	2,155	149
Salem	664	50,395	793	57
Coimbatore ...	529	283,143	4	...
Trichinopoly ...	247	47,660	330	12
Tanjore ...	130	1,163	139	81
Madura ...	176	148,850	17	4
Rāmnād ...	14	206,843	62	...
Tinnevelly ...	449	271,315	193	Nil.
Malabar ...	165	600	...	...
South Kanara ...	352	548	...	...
The Nilgiris ...	...	...	...	...
Grand total ...	184,835	2,388,523	53,639	4,602

Statement showing the area with crops in 1926–27—*cont.*

District.	Total dyes. (42)	Tobacco. (43)	Other drugs and narcotics. (44)	Total drugs and narcotics. (45)
	ACS.	ACS.	ACS.	ACS.
Ganjām	750	2,211	482	2,693
Vizagapatam ...	3,530	51,578	5,517	57,095
Gōdāvari, East...	626	11,349	544	11,893
Do. West ..	43	5,543	46	5,589
Kistna	1,930	6,220	20	6,240
Guntūr	1,867	66,346	376	66,722
Kurnool ...	3,662	5,130	3,958	9,088
Bellary	238	3,275	531	3,806
Anantapur ...	1,063	3,540	1,229	4,769
Cuddapah ...	8,572	1,206	753	1,959
Nellore	8,791	2,215	540	2,755
Chingleput ...	2,521	28	1,663	1,691
South Arcot ...	9,696	2,335	905	3,240
Chittoor ...	10,956	793	1,377	2,170
North Arcot ...	2,304	4,103	1,413	5,516
Salem	850	4,245	11,705	15,950
Coimbatore ...	4	38,596	25,684	64,280
Trichinopoly ...	342	4,645	1,258	5,903
Tanjore ...	220	2,357	2,258	4,615
Madura ...	21	10,970	12,539	23,509
Rāmnād ...	62	2,768	2,590	5,358
Tinnevelly ...	193	1,115	7,061	8,176
Malabar ...	..	40	95,205	95,245
South Kanara ...	...	1,522	18,063	19,585
The Nilgiris ...	...	25	48,176	48,201
Grand total ...	58,241	232,155	243,893	476,048

Statement showing the area with crops in 1926-27—*cont.*

District.	Fodder crops. (46)	Miscellaneous non-food crops. (47)	Total non food crops. (48)
	ACS.	ACS.	ACS.
Ganjām	1,272	13	125,468
Vizagapatam ...	23,650	1,602	493,719
Gōdāvari, East...	18,441	45	196,741
Do. West...	5,502	13	89,017
Kistna	107,173	253	203,094
Guntūr	186,589	409	578,544
Kurnool... ...	93	1,972	652,610
Bellary	554	7,579	773,860
Anantapur ...	108	5,963	573,134
Cuddapah ...	57	12,153	351,360
Nellore	1,674	2,777	103,728
Chingleput ...	...	18,670	97,702
South Arcot ...	19	11,255	453,867
Chittoor... ...	45	1,406	150,038
North Arcot ...	...	17,465	416,705
Salem	8,054	1,661	229,475
Coimbatore ...	5	11,320	532,614
Trichinopoly ...	54	1,215	211,368
Tanjore	...	14,235	175,786
Madura	2,231	6,041	267,032
Ramnad... ...	34,205	3,147	313,328
Tinnevelly ...	63,831	21,042	438,129
Malabar.. ...	18	26,457	463,251
South Kanara ...	976	219	73,515
The Nilgiris ...	90	852	49,244
Grnnd total ...	454,641	167,765	8,013,329

Statement showing the area with crops in 1926–27—*cont.*

District.	Grand total. (49)	Area sown more than once. (50)	Net area cropped. (51)
	ACS.	ACS.	ACS.
Ganjām	1,817,336	308,934	1,508,402
Vizagapatam ...	3,066 852	444,196	2,622,656
Gōdāvari, East ..	1,261,372	266,626	994,746
Do. West...	949,955	207,764	742,191
Kistna	1,177,880	128,661	1,049,219
Guntūr	2,221,383	253,577	1,967,806
Kurnool... ...	2,079,470	29,281	2,050,189
Bellary	2,427,212	25,849	2,401,363
Anantapur ...	2,080,696	56,115	2,024,581
Cuddapah ...	1,130 806	70,930	1,059,875
Nellore	1,294,615	103,507	1,191,108
Chingleput ...	909,073	139,026	770,047
South Arcot ...	1,506,065	178,915	1,327,150
Chittoor... ...	800,818	106,443	694,375
North Arcot ...	1,320,568	165,284	1,155,284
Salem	1,806,238	219,408	1,586,830
Coimbatore ...	2,158,258	249,815	1,908,443
Trichinopoly ...	1,383,726	103,252	1,279,774
Tanjore	1,458,243	106,285	1,351,958
Madura	1 393,025	172,857	1,220,168
Rāmnād	1,191,107	59,805	1,131,302
Tinnevelly ...	1,393,774	224,015	1,169,759
Malabar... ...	1,712,718	278,793	1,433,925
South Kanara ...	743,237	199,929	543,308
The Nilgiris ...	82,705	4,125	78,580
Grand total ...	37,367,132	4,104,092	33,363,040

CALENDAR.

LIST OF TAMIL, TELUGU, KANARESE, AND MALAYALAM MONTHS CORRESPONDING WITH ENGLISH MONTHS.

English.	Tamil.	Malayalam.	Telugu, Kanarese.
Jan. 16—Feb. 15 ...	Thai ...	Makaram ...	Pushyam ...
Feb. 16—Mar. 15...	Masi ...	Kumbham ...	Magham ...
Mar. 16—Apr. 15 ...	Panguni ...	Meenam ...	Phalghunam...
Apr. 16—May 15 ...	Chittirai ...	Medam ...	Chaitram ...
May 16—June 15...	Vaiyasi ...	Idavam ...	Vaisakham ...
June 16—July 15 ...	Ani ...	Mithunam ...	Jeshtam ...
July 16—Aug. 15...	Adi ...	Karkitaka ...	Ashadham ...
Aug. 16—Sep. 15 ...	Avani ...	Chingam ...	Sravanam ...
Sep. 16—Oct. 15 ...	Purattasi ...	Kanni ...	Bhadrapada...
Oct. 16—Nov. 15 ...	Appisi ...	Thulam ...	Asweejam ...
Nov. 16—Dec. 15 ...	Kartigai ...	Vrichikam ...	Kartigam ...
Dec. 16—Jan. 15 ...	Margali ...	Dhanu ...	Margasiram...

Karthulu (Telugu).	English.
Uttrashada ...	January 10—22.
Sravanam ...	January 23—February 4.
Dhanishta ...	February 5—17.
Satabhisha ...	February 18—March 2.
Purvabhadra...	March 3—15.
Uttarabhadra..	March 16—27.
Revati ...	March 28—April 10.
Asvani ...	April 11—25.
Bharani ...	April 26—May 9.
Krittika ...	May 10—23.
Rohini ...	May 24—June 6.
Mrugasira ...	June 7—22.
Arudra ...	June 23—July 4.
Punarvasu ...	July 5—18.
Pushya ...	July 19—August 1.
Aslesha ...	August 2—15.
Maka ...	August 16—29.
Pubba ...	August 30—September 11.
Uttara ...	September 12—25.
Hasta ...	September 26—October 8.
Chitra ...	October 9—22.
Swati ...	October 23—November 4.
Visakha ...	November 5—17.
Anoradha ...	November 18—30.
Jeshta ...	December 1—14.
Mula ...	December 15—27.
Purvashadha...	December 28—January 9.

INDEX.

A

Abortion (cattle), 137.
Do. (sheep), 147.
Acacia arabica, 185, 198.
Do. farnesiana, 185.
Adhatodavasica, 187.
Adina cordifolia, 200.
Agaththi, 184.
Do. grandiflora, 192.
Do. Insect pests of, 172.
Agave, 91.
Agave americana, 91, 185.
Do. sisalana, 91.
Do. vera cruz, 91.
Age of cattle, 123.
Do. sheep, 142.
Ala, 201.
Albizzia Lebbek, 199.
Allium Cepa, 93.
Do. Sativum, 93.
Alteratives and tonics (recipes), 148.
Amaranth, 81.
Amaranthus gangeticus, 81.
Amorphuphallus Campanulatus, 79.
Anæsthetics, 149.
Anantapur, weights and measures of, 4.
Angular measure, 18.
Animals, life of, 159.
Anogeissus latifolia, 199.
Anthelmintics (recipes), 148.
Anthrax (cattle), 129.
Do. (sheep), 143.
Antiparasitics (recipes), 149.
Antipyretics (recipes), 149.
Antiseptics (recipes), 150.
Aphtha (sheep), 145.
Apoplexy, parturient, 135.
Arachis hypogea, 86.
Arasanikai, 77.
Arecanuts, 189.
Do. fungus diseases of, 180.
Arrowroot, 80.
Artocarpus integrifolia, 201.
Arundo donax, 184.
Ashes, 56.
Ash gourd or ash pumpkin, 83.
Astringents (recipes), 151.
Average yield of principal crops, 206, 207.
Azadirachta indica, 195.

B

Babul, 173, 185.
Babul topes, 192.
Do. tree, 198.
Balsamodendron Berryi, 184.
Bamboo topes, 192.
Banyan tree, 201.
Batavian orange gardens, 191.
Beans, cluster, 76.
Bellary, weights and measures of, 4.
Bengal gram, 39, 70.
Do. fungus diseases of, 176.
Benincasa cerifera, 83.
Betel, 99.
Bignonia megapotamica, 186.
Bimlipatam jute, 90.
Bishop's weed ,96.

Bitter gourd, 82.
Black gram, 73.
Do. plum, 200.
Do. quarter, 130.
Black water, 133.
Black wood, 196.
Bloody flux (sheep), 145.
Bone manures, 53.
Borassus flabellifer, 185, 201.
Bordeaux mixture, 181.
Brassica juncea, 96.
Breeding (cattle), 117.
Breeding and rearing (sheep), 140.
Bricks, 29.
Brinjal, 75.
Bronchitis (cattle), 132.
Do. (sheep), 144.
Buffalo's milk, analysis of, 165.
Buildings, 29.
Bullock hoeing, 41.
Bulrush, 65.
Bundling seedlings, 42.
Butter, analysis of, 166.
Buttermilk, analysis of, 166.

C

Caesalpinia crista, 186.
Do. pulcherrima, 186.
Cajanus indicus, 71.
Cakes, analysis of, 54.
Calabash or calabash cucumber, 83.
Calves, feeding of, 111.
Calving table, 125.
Cambodia cotton, 90.
Cancer, 126.
Cane harvesting, 37.
Canes, wrapping, 44.
Cannabis sativa, 100.
Cannanore, weights and measures of, 10.
Capsicum annuum, 92.
Cardamom, 98.
Cardials (recipes), 152.
Carilla fruit, 82.
Carissa Carandas, 186.
Carthamus tinctorius, 88.
Carting manure, 37.
Do. silt, 37.
Carts, draughts of, 36.
Carum copticum, 96.
Cassia angustifolia, 100.
Castor, 86.
Castor cake, analysis of, 54.
Casuarina equisetifolia, 184.
Casuarina topes, 191.
Catarrh (sheep), 144.
Cattle manure, 51.
Cattle rearing, 119.
Cedrela toona, 195.
Cephalandra indica, 81.
Cereals, 63.
Do. fungus diseases of, 174.
Chadurakkalli, 184.
Chaffing fodder, 38.
Chayroot, 103.
Chillies, 92.
Do. picking of, 47.
Do. fungus diseases of, 178.
Chingleput, weights and measures of, 5.
Chirakkal Taluk, weights and measures of, 8.
Chittoor and Chandragiri, weights and measures of, 5
Chloroxylon swietenia, 196.
Choking, 131.
Cholam, 64.
Do. fungus diseases of, 174.
Chowk maram, 184.
Cicer arietinum, 70.
Citrullus vulgaris, 77.
Clearing land, 37.
Clod crusher, 37.
Cluster bean, 76.
Coconut, fungus diseases of, 179.

Coconut gardens, 187.
Do. picking, 47.
Do. planting, 41.
Coimbatore, weights and measures of, 5.
Cold, 144.
Collyria (recipes), 152.
Colocasia, 79.
Colocasia antiquorum, 79.
Colostrum, analysis of, 166.
Common fungus diseases, 174.
Common insect pests, 169.
Common millet, 67.
Composition of food, 104.
Do. rations, 107.
Concrete, 29.
Condiments and spices, 92.
Conjunctivitis, 135.
Contagious foot-rot (sheep), 144.
Contract, labour by, 45.
Conversion factors, 19.
Coriander, 94.
Coriandrum sativum, 94.
Costiveness in newly born calf, 138.
Cost of feeding calves, 114.
Cost of feeding cows per annum, 113.
Cost of feeding pair of cattle per annum, 112.
Cost of pumping water, 33.
Cotton, 39, 89.
Do. fungus diseases of, 179.
Cotton ginning, 37, 45.
Do. insect pests of, 171.
Do. picking, 40, 45.
Do. stalks removing, 40, 45.
Cow gram, 74.
Do. pea, 74.
Do. pox, 128.
Cow's milk, analysis of, 165.
Cream, analysis of, 165.
Cropping of districts—table showing, 206.
Crops, 63.
Crotolaria juncea, 91.
Crowbarring, 37, 45.
Cucumber, 76.
Cucumis melo, 77.
Do. sativus, 76.
Cucurbita maxima, 76.
Do. moschata, 77.
Do. pepe, 77.
Cuddapah, weights and measures of, 6.
Cultivating, 37.
Cumbu, 45, 170.
Do. fungus diseases of, 174.
Cuminum cyminum, 95.
Cummin, 95.
Curcuma angustifolia, 80.
Do. longa, 94.
Cyamopsis psoralioides, 76.

D

Dairy, equipment of, 168.
Dairying, 164.
Do. useful data, 166.
Dalbergia latifolia, 196.
Deccan hemp, 90.
Demulcents (recipes), 153.
Dentition (cattle), 123.
Do. (sheep), 141.
Dew gram, 74.
Diarrhœa (calves), 139.
Do. (cattle), 132.
Do. (sheep), 145.
Digestive coefficients, 112.
Digging cane stubbles, 45.
Do. hariali, 45.
Do. wells, 46.
Do. wet land with mammutti, 37, 45.
Dioscorea, 79.
Diseases, common fungus, 174.

Disinfectants, 152.
Disinfection, 159.
Distention of the rumen, with gas, 145.
Diuretics (recipes), 153.
Dolichos biflorus, 72.
Do. lablab, 72.
Downfall of the calf bag, 137.
Downfall of the udder, 138.
Drilling, 38.
Dropping after calving, 135.
Drugs and narcotics, 99.
Dryage of stored grains, 103.
Duty of water, 34.
Dyes, 102.
Dysentery (cattle), 132.
Do. (sheep), 145.

E

Ecbolics parturients (recipes), 153.
Elephant grass, 84.
Do. yam, 79.
Elettaria cardamomum, 98.
Eleusine Coracana, 65.
Emollients, 153.
Ernad Taluk, weights and measures of, 9.
Eugenia jambolana, 200.
Euphorbia antiquorum, 184.
Do. tirucalli, 184.
Exile oleander, 185.
Expectorants (recipes), 153.
Extracting fibre, 39.
Eye washes (recipes), 152.

F

Fasli, 3.
Febrifuges (recipes), 149.
Feeding, cost of, 112—116.
Feeding, live-stock, 121.
(See also food and feeding.)
Feeding sheep, 141.
Fenugreek, 98
Fever, milk, 135.
Do. simple, 126.
Fibre, 89.
Do. crops, fungus diseases of, 179.
Do. extracting, 39.
Ficus Bengalensis, 201.
Field bean, 72.
Filaria lachrymalis, 135.
Fish guano, 54.
Do. manure, 54.
Fixing bamboos, 45.
Flies (sheep), 147.
Fodder cholam, 64.
Food and feeding, 104.
Food, composition of, 104.
Foot and mouth disease, (cattle), 127.
Foot and mouth disease, (sheep), 143.
Foot-rot, 144.
Foul, 134.
Fracture of the horn, 136.
Fruit crops, fungus diseases of, 180, 181.
Fungicides, 181.
Fungus diseases, common, 174.

G

Gadfly (sheep), 147.
Ganjam, weights and measures of, 6.
Garden produce, 75.
Gardens, coconut, 187.
Do. jack, 189.
Do. mango, 189.
Do. orange, Batavian, 191.
Do. plantain, 190.
Garget (cattle), 138.
Do. (sheep), 148.
Gargles (recipes), 152.
Garlic, 93.
Gestation, periods of, 143, 157.

Gingelly, 85.
Ginger, 97.
Do. fungus diseases of, 178.
Goat's milk, 175.
Gōdāvari, weights and measures of, 6.
Gossypium, 89.
Gourd, ash, 83.
Do. bitter, 82.
Do. ribbed, 83.
Do. snake, 82.
Gram, Bengal, 70.
Do. black, 73.
Do. cow, 74.
Do. dew, 74.
Do. green, 73.
Do. horse, 72.
Do. red, 71.
Grapevine, fungus diseases of, 181.
Grass, Guinea, 84.
Do. Elephant, 84.
Green gram, 73.
Do. manures, 57.
Grewia tiliæfolia, 195.
Grinding, 39.
Groundnut, 39, 86.
Do. cake, analysis of, 54.
Do. fungus diseases of, 177.
Do. Insect pests of, 171.
Groundnut, lifting, 40.
Do. sowing, 43.
Guano (fish), 54.
Guinea grass, 84.
Guizotia abyssinica, 87.
Guntaka working, 38.

H

Hæmorrhagic septicæmia, 128.
Hardwickia binata, 197.
Harrowing, 39.
Harvesting, Bengal gram, 40.
Harvesting, cholam, 40.
Do. cumbu, 40.
Do. fodder cholam, 40.
Do. groundnut, 40.
Do. onions, 40.
Do. paddy, 41.
Do. ragi and tenai, 41.
Do. Sweet potatoes, 40.
Do. Tobacco, 41.
Do. Turmeric, 41.
Hedge plants, 183.
Height, measurement of, 25.
Hemp, Deccan, 90.
Henna, 185.
Hepatitis, 132.
Hibiscus cannabinus, 90.
Do. esculentus, 78.
Horn, fracture of the, 136.
Horse gram, 72.
Horse power, 31.
Horticulture, 183.
Hoven, (sheep), 131, 145.
Hurdles, rate for, 46.
Husking, paddy, 41.
Hydrophobia (sheep), 144.

I

Impaction of the rumen, 131
Implements, draught of, 36.
Incubation of poultry, 157.
Indian hemp, 100.
Indian walnut, 198.
Indigo, 102.
Indigofera sumatrana, 102.
Inflammation of the lungs, (sheep), 133.
Inflammation of the kidney, 133.

Inflammation of the udder (cattle), 138.
Inflammation of the udder (sheep), 144, 148.
Insect pests, common, 164.
Instruments, veterinary, 156.
Inter-culturing, 41.
Inversion of the womb, 137.
Ipomœa batatas, 78.
Ironwood, 198.
Irritants (recipes), 154.
Irul, 198.
Italian millet, 66.
Iti, 196.

J

Jack gardens, 189.
Jack tree, 201.
Jatropha curcas, 187.
Do. gossypifolia, 187.
Jonna, 39.
Jute, Bimlipatam, 90.

K

Kainit, 53.
Kalakkai, 186.
Kaliyana pushini, 83.
Kambu, 65.
Kanarese months corresponding with English months, 223.
Karamani, 74.
Karanai kizhangu, 80.
Karumarudu, 199.
Karum porasu, 196.
Karum sembai, 185.
Karu velam, 185, 198.
Kattamanakku, 187.
Kaththalai, 185.
Kino tree, 197.
Kiraithandu, 81.
Kodo millet, 68.
Korali, 70.
Korukapili, 183.
Kovai, 81.
Kudiraivali, 68.
Kurnool, weights and measures of, 8.

L

Labour, 37.
Lady's fingers, 78.
Lagenaria vulgaria, 83.
Lambing table, 143.
Laminitis, 134.
Lawsonia alba, 185.
Leaf, green, 57.
Leucana Glauca, 187.
Levelling, methods of, 26.
Life of animals, 159.
Lime, 29.
Lingarali, 185.
Linseed, 88.
Linum usitatissimum, 88.
Live-stock, 117.
Liver rot, 145.
Loam, 48.
Local weights and measures, 4, 18.
Lock jaw (sheep), 146.
Loofah, 84.
Lousiness (cattle), 134.
Do. (sheep), 147.
Lucerne, 85.
Luffa ægyptiaca, 84.
Luffa acutangula, 83.
Luxation, 136.

M

Machinery, 31.
Madalam, 186.
Madura, weights and measures of, 10.
Maize, 69.
Malabar, Walluvanad Taluk, weights and measures of, 8.

Malayalam months, corresponding with English months, 223.
Mamaram, 196.
Mammitis, 138.
Mangalore, weights and measures of, 14.
Mange, 134.
Mangifera indica, 196.
Mango, 171, 196.
Do. fungus diseases of, 180.
Do. gardens, 189.
Do. insect pests of, 172.
Manihot utilissima, 79.
Manjakadambe, 200.
Manures, 51.
Do. common, 54.
Do. farm-yard, 51.
Do. green, 57.
Do. nitrogenous, 52.
Do. phosphatic, 52.
Do. spreading, 43.
Do. unit prices of, 59.
Manurial factors, 61.
Do. values, 60.
Margosa, 195.
Marrow, vegetable, 77.
Maruthani, 185.
Mayil konnai, 186.
Measures, 1.
Do. local, 4.
Medicago sativa, 85.
Melia indica, 195.
Melons, 77.
Do. musk, 77.
Do. water, 77.
Mensuration and surveying, 20.
Metal road, 30.
Metrical weights and measures, 18.
Milk, analysis of, 165.
Do. fever, 135.
Do. hedge, 184.
Do. yields of cows, 164.
Mill refuse, 55.
Millet, common, 67.
Do. italian, 66.
Do. kodo, 68.
Do. sanwa, 68.
Do. spiked, 65.
Millets, insect pests of, 170.
Minerals, rock-forming, 48.
Miscarriage, 137.
Mislocation, 136.
Mixing manures, 60–62.
Momordica charantia, 82.
Months, vernacular names of, 223.
Mortar, 29.
Mullukiluvai, 184.
Musk melon, 77.
Mustard, 96.

N

Naga, 200.
Narcotics, 99.
Naval, 200.
Navel, 138.
Nephritis, 133.
Nicotiana tabacum, 99.
Niger seed, 87.
Nightsoil, 57.
Nilgiris, weights and measures of, 10.
Nim, 195.
Norai peerkan, 84.
North Arcot, weights and measures of, 11.

O

Oestrum, 158.
Oil seeds, 85.
Oldenlandia umbellata, 103.
Omum, 96.
Onions, 93.
Opuntia Dillenii, 183.
Orange, fungus diseases of, 180.
Oryza sativa, 63.

P

Paddy, 39, 63.
  Do. fungus diseases of, 176.
  Do. harvesting, 46.
  Do. insect pests of, 169.
Palms, fungus diseases of, 179.
Palms, insect pests of, 173.
Palmyra palm, 185, 201.
  Do. fungus diseases of, 179.
Panai, 185, 201.
Panicum crusgalli, 68.
  Do. frumentaceum, 68.
  Do. maximum, 84.
  Do. miliaceum, 67.
  Do. miliare, 67.
Para (of lime), 29.
Paralysis, 135.
Parasites, 160.
Parturient apoplexy, 135.
Paspalum scrobiculatum, 68.
Pasturage fees, 116.
Pati mannu, 56.
Pavakkai, 82.
Peacock flower, 186.
Pedilanthus tithymaloides, 187.
Peerkan, 83.
Pee velan, 185.
Pekkarumbu, 184.
Penning cattle, 46.
Pennisetum typhoideum, 65.
  Do. purpurea, 84.
  Do. insect pests of, 170.
Pepper, 96.
Periods of gestation of domestic animals, 157.
Periods of heat, 158.
Pests, common insect, 169.
Phaseolus aconitifolius, 74.
  Do. Mungo, 73.
  Do. Mungo, radiatus, 73.
Picking cotton, 45.
Piper betel, 99.
  Do. nigrum, 96.
Pithecolobium dulce, 183.
Plantain gardens, 190.
Planting canes, 41.
Pleuro-pneumonia contagiosa, 127.
Ploughing (labour), 42.
Ploughs, draughts of, 36.
Pneumonia (cattle), 133.
  Do. (sheep), 144.
Poinciana elata, 185.
Pomegranate, fungus diseases of, 186.
  Do. insect pests of, 173.
Poonacs, analysis of, 54.
Potash, 53.
Potato, 81.
  Do. fungus diseases of, 177.
Potatoes, sweet, 78.
Prices of food grains per imperial maund (82 lb.), 205.
Prickly-pear, 183.
Prismoid, measurement of, 22.
Pruning of trees, 193.
Pterocarpus marsupium, 197.
Pudalangai, 82.
Pulichai, 90.
Pulimanji, 90.
Pulse (of animals), 158.
Pulses, 70.
  Do. fungus diseases of, 176.
Pumping water, 32.
Pumpkin, 76.
Pumpkin, ash, 83.
Pungam cake, analysis of, 54.
Punica granatum, 186.
Punnai cake, analysis of, 54.
Purgatives (recipes), 154.

R

Rabies (sheep), 144.
Ragi, 65.
Do. fungus diseases of, 175.
Rainfall table, 204.
Rations, composition of, 107.
Do. for calves at the Military Dairy, Bangalore, 116.
Rations, specimen, 109—111.
Rearing (cattle), 119.
Do. (sheep), 140.
Recipes, 148.
Red cedar, 195.
Red gram, 71.
Red water, 133.
Respiration, 158.
Retention of after-birth or placenta, 137.
Rheumatism, 126.
Ribbed gourd, 83.
Ricinus communis, 86.
Ridging (labour), 43.
Rinderpest (cattle), 127.
Do. (sheep), 143.
Ringworm, 134.
Roads, 29.
Rope making (labour), 43.
Rosewood, 196.
Rot (sheep), 145.

S

Sacharum arundinaceum, 184.
Do. officinarum, 101.
Safflower, 88.
Safflower cake, analysis of, 54.
Salem, weights and measures of, 11.
Samai, 67.
Santhana vembu, 195.
Sanwa millet, 68.
Sappaththi mullu, 183.
Satinwood, 196.
Savell ill, 138.
Sawing timber, 47.
Scab (sheep), 147.
Scrofula (sheep), 144.
Scour, 139.
Seemai kattamanakku, 187
Senna, 100.
Sesamum indicum, 85.
Sesbania aculeata, 192.
Do. ægyptiaca, 185.
Do. grandiflora, 184.
Setaria glauca, 70.
Do. italica, 66.
Shearing (sheep), 141.
Sheep, 139.
Do. breeds of, 139.
Do. penning, 47.
Do. pox, 143.
Simple fever, 126.
Simple ophthalmia, 135.
Siththagathi, 185.
Skim milk, analysis of, 165.
Smut, on cholam and cumbu 174.
Do. on tenai, 175.
Do. on sugarcane, 180.
Do. (false) on paddy, 176.
Snake gourd, 82.
Soils, 48.
Do. chemical analysis of, 49.
Soils, mechanical analysis of, 50.
Solanum melongena, 75.
Do. tuberosum, 81.
Sorakkai, 83.
Sore teats, 138.
Sorghum, insect pests of, 170.
Sorghum vulgare, 64.
South Arcot, weights and measures of, 12.
South Kanara, weights and measures of, 13.
Sowing broadcast (labour), 43.

Sowing modan paddy in Malabar, 43.
Specimen rations, 109.
Spices, 92.
Spiked millet, 65.
Spreading manure, 43.
Sprain, 136.
Stack, measurement of, 23.
Statistics, agricultural, 202.
Stimulants (recipes), 152.
Straw, twists, 47.
Straw, weight of, 23.
Sugarcane, 101.
Do. fungus diseases of, 180.
Do. insect pests of, 171.
Sugars, 101.
Sunnhemp, 39, 91.
Surki, 29.
Surveying, 20.
Sweet potatoes, 78.
Do. harvesting, 47.

T

Tagarai chedi, 187.
Tamarind, 186, 197.
Tamarindus indica, 186, 197.
Tamil months corresponding with English months, 223.
Tanjore, weights and measures of, 15.
Tangarali, 186.
Tannery refuse, 55.
Tapioca, 79.
Teak, 200.
Teats, sore, 138.
Tecona stans, 186.
Tectona grandis, 200.
Teeth, age from (cattle), 124.
Do. (sheep), 142.
Tekku, 200.
Telugu months, corresponding with English months, 223.
Tellicherry, weights and measures of, 10.
Temperature of animals, 158.
Tenai, 66.
Do. fungus diseases of, 175.
Terminalia tomentosa, 199.
Tetanus (sheep), 146.
Thadasu, 195.
Thatching, 43.
Thenai, 66.
Thevetia neriifolia, 185.
Thirugukalli, 184.
Threshing (labour), 43.
Ticks (sheep), 147.
Timber trees, common, 195.
Tinnevelly senna, 100.
Do. weights and measures of, 15.
Tobacco, 99.
Do. fungus diseases of, 177.
Toddy palm, 231.
Tonics, alteratives and, 148.
Topes, casuarina, 191.
Do. babul, 192.
Do. bamboo, 192.
Trenching, 44.
Trichinopoly, weights and measures of, 15.
Trichosanthes anguina, 82.
Trigonella fœnumgræcum, 98.
Trismus, 146.
Triticum sp., 69.
Tuberculosis (cattle), 126.
Do. (sheep), 144.
Tumours, wounds and, 136.
Turmeric, 94.
Do. fungus diseases of, 178.
Turmeric, lifting, 47.

Tuvarai, 71.
Tympanitis (cattle), 131.
Do. (sheep), 145.
Typhonium trilobatum, 80.

U

Unit prices of manures, 59.

V

Varagu, 68.
Vage, 199.
Variola ovina (sheep), 143.
Vegetable and garden produce, 75.
Vegetable marrow, 77.
Velnage, 199.
Vembu, 195.
Venge, 197.
Vermifuges (recipes), 148.
Veterinary instruments and appliances, 156.
Vigna catiang, 74.
Village earth, 56.
Do. refuse, 56.
Vizagapatam, weights and measures of, 17.

W

Walnut, Indian, 199.
Watching paddy, 44.
Water lifting, 31.
Water melons, 77.
Weeding, 44.
Weights and measures, 1.
Weights and measures, local, 4.
Weights and measures (veterinary), 155.
Wheat, 69.
Wheat, fungus diseases of, 175.
Whey, analysis of, 166.
Whitewashing, 44.
Winnowing, 44.
Working guntaka, 38.
Worm in the eye, 135.
Wounds and tumours, 136.
Wrapping canes, 44.

X

Xylia dolabriformis, 198.

Y

Yam, elephant, 79.
Yield, average, of principal crops, 206 - 209.

Z

Zea Mays, 69.
Zingiber officinale, 97.